AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 10, No. 28 WEEKLY. | NEW YORK, JULY 9, 1887. | $2.50 per Annum. SINGLE COPIES, 5 CENTS.

COPYRIGHT 1887, BY AMERICAN MACHINIST PUBLISHING COMPANY. For Sale Everywhere by Newsdealers. ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

The Hoppes Feed Water Purifier.

We have previously illustrated this purifier, but since then its mechanical construction has been very materially modified.

The purifier consists essentially of a shell of boiler iron, the heads being secured to rings riveted to each end.

Within the shell are a number of trough-shaped pans or trays, placed one above another, and supported on steel angle ways, fixed longitudinally by means of brackets to the sides of the shell.

These troughs are formed from thin sheet steel, the heads or end pieces being malleable iron, whereby a very light, strong and durable construction is obtained, and a degree of elasticity or resilience secured to the troughs, which permits the lime or other incrustations being easily removed. The ends of the troughs are higher than the sides, and have projections at each extremity to rest on the ways on which the troughs are adapted to slide.

Six troughs are placed in a tier, and from one to four tiers used, according to the capacity required.

The sectional cut illustrates a purifier with two tiers of troughs and the arrangement for dividing and distributing the feed-water in the top troughs of each tier.

The purifier is connected to the boiler by a large steam pipe *A*, and the exit or gravity pipe *D*. A blow-off pipe is also connected to the purifier at *C*.

The feed-pipe from the pump or boiler feeder is attached at *B*.

A water column and gauge is also connected, as shown in the exterior view of the purifier, and while in operation this gauge should never show more than half full of water.

In packing the heads, which are both removable, round asbestos packing is placed in a groove turned in the ring, and is held in place by a corresponding annular projection on the head. This makes a most effectual and lasting joint, and dispenses with the use of large gaskets.

In operating the purifier, the water is pumped in at *B*, and distributed into the upper troughs through the water-sealed overflow boxes, shown in the top of cut. When the trough is filled, the water flows over the sides, and following the under surface, flows in a thin uniform sheet along the bottom until it reaches the center, when it falls into the trough below, and so on over each successive trough until it reaches the bottom of the shell, from which it passes through pipe *D*, into the boiler.

The water, flowing in a thin uniform sheet along the under surface of the troughs, and being subjected to the direct action of the steam, is heated to the boiler temperature, and parts with the scale-making properties it contains, the greater part of which adheres to the under sides of the troughs.

While the purifier is in operation, the troughs remain full of water, and afford ample settling chambers for the heavier solids, such as mud, sand, etc., while the carbonates, sulphates, silica and other hard scale-making properties, adhere to their under sides.

The success of the purifier is altogether due to the use of this under surface, as by its use only, can the harder scale-making properties be removed from the feed water before going to the boiler.

When the purifier is ready to clean, which is usually after from thirty to sixty days' run, from 1″ to 2″ of scale will be found on the under side of the two upper troughs, $\frac{1}{2}$″ to $\frac{3}{4}$″ on the third, $\frac{1}{32}$″ to $\frac{1}{8}$″ on the fourth, and about $\frac{1}{64}$″ on the under sides of the two lower troughs.

Scale taken from the under side of the top trough is usually soft, but that from each succeeding trough is harder and thinner than the one above, that from the two lower troughs being very hard, and almost transparent.

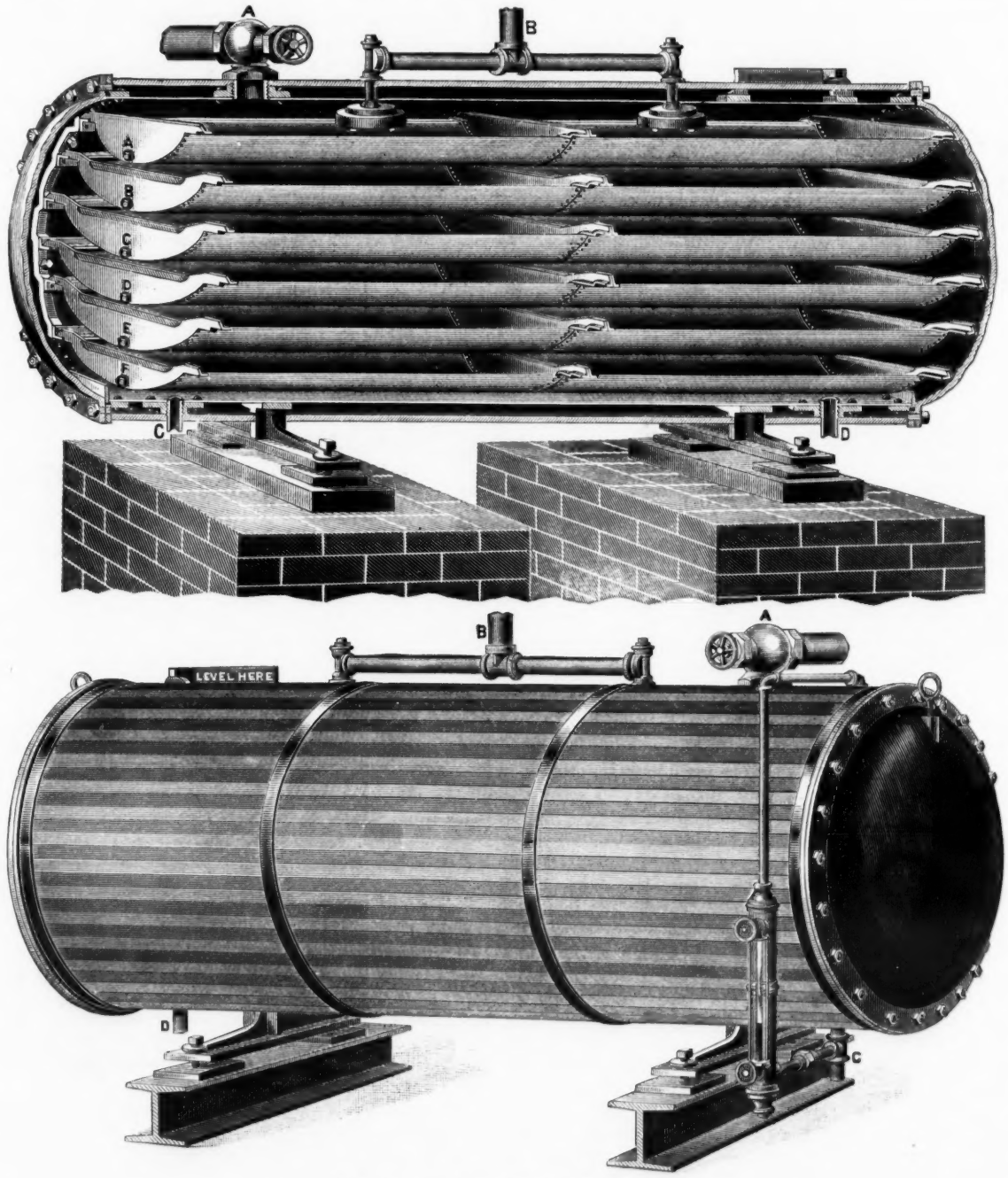
The extreme thinness and sometimes entire absence of scale on the under side of the lower troughs makes it evident that the water, in passing through the purifier, is made practically pure, and cannot cause scale in the boiler.

To clean the purifier, first close the boiler connections *A* and *D*, and cool down by pumping in cold water, and blowing off at *C*. The sudden change of temperature will cause most of the scale to burst off the under sides of the troughs, leaving very little to remove by hand. One head is then removed, and the water drawn out of the troughs by removing the plugs in the front ends. The troughs are then withdrawn and the remaining scale jarred off by dropping the troughs on a solid floor, or by scraping, after which they should be washed or swept clean. Care should be taken not to hammer or bend the troughs out of shape.

The purifier should be placed on a solid foundation in such position as will bring the under side of the shell at least 18 inches above the water level of the boilers.

The steam pipe *A* and gravity pipe *D* should each be connected to all of the boilers supplied by the purifier.

These purifiers are made by the Hoppes Manufacturing Company, Springfield, Ohio.



THE HOPPES FEED-WATER PURIFIER.

Ethics in a Machine Shop.

BY JARNO.

I.

I use the term ethics, as closely connected with morals or right doing, or perhaps as applied to rules of action somewhat between etiquette and legal considerations. My neighbor, in passing, may not stare me out of countenance, because it is not polite. If I allow him to build his house so that the eaves shed water upon my land, he might shortly build a fence between me and his eaves-droppings, were it not for legal restrictions.

Between like extremes, cases occur in a machine shop where decisions have to be made purely upon ethical grounds, and not by legal aspect, although I suppose it is the frequent recurrence of things leading to misunderstanding which causes the enactment of laws.

Whether man has by nature a moral sense or conscience, or his ideas of right are the result of education, need not be here discussed. We will merely admit that education has something to do with our manner of dealing with each other.

To this end, the cases cited in the following have been carefully studied, and it is thought that the suggestions and decisions will be found to accord with the best practice.

1. A party sent a blank to a machine shop, with an order to cut it into a sprocket wheel of thirty teeth, to fit a chain, also sent with the blank.

After the wheel had been cut, it was found that the linear pitch was too short to fit the chain, because the blank had been turned too small, and hence the job was spoiled.

The party was notified, and he sent a new blank then, saying that if the wheel had 28 or 29 teeth, and a corresponding change of diameter, it would answer. When the new wheel was shipped, a bill was rendered for the whole time spent on both wheels. The bill was returned as incorrect, because, it was alleged, the time on the spoiled wheel should not have been charged for. It was held at the machine shop that as the party had sent the blank all turned and had specified the number of teeth to be cut, the mistake was his, and he should bear the loss. Several letters passed without reaching an agreement, and it was finally, by mutual consent, left to a third party.

It was decided that although the party ordering had made a mistake in sizing the blank, yet sufficient attention had not been paid to that fact, also given in the order, that a wheel was wanted to fit the chain, and hence the machine shop should bear the loss.

The plain principle in such cases would appear to be: Before cutting into a blank or piece of stock furnished by a customer, due caution should be taken that the conditions are such as give a reasonable assurance that a good job will be obtained. It is well to examine immediately upon receipt of order, so that if there has been any mistake the customer can at once be notified.

The foregoing case has often been referred to and discussed.

Some are still inclined to hold that the customer should have borne half the loss at least. This is met by the consideration that the delay to his business might have been more damaging than the loss of many blanks. We certainly should not expect to be excused for turning a chip from a blank 2″ diameter in the rough with the expectation that it would finish 2″ diameter. On the whole the rule given is substantially just.

2. When special tools are made to further ordered work, do the tools belong to the party who orders the work or to the party who fills the order?

This question has been a fruitful source of misunderstanding and annoyance.

The rule is now pretty well established that in the absence of special agreement such tools always belong to the machine shop filling the order. Among the reasons for this rule may be named: By making special tools and fixtures an order is often filled at less cost and of a better quality than if done with regular tools; in filling an order it should not be expected that tools and instruction be given which will better enable a customer to have future orders filled elsewhere. Yet the conditions are so varied that it is better to have a written understanding before work is commenced. A few pieces may be ordered for the very purpose of learning better methods of manufacturing and also for obtaining improved tools; in this an order should be very explicit.

If a customer and a machine maker have too much confidence in each other at the start, they may have too little confidence in each other at the end.

3. There is a rule that savors more of policy than of ethics which has been brought about first by the disposition of machine makers to look after their customers' interest, using the same means that they would in manufacturing their own products, and second, because customers cannot or will not recognize either this disposition or the economy of the methods adopted. Suppose a dozen hardened steel bushings are ordered—these bushings to be ground both inside and outside. On account of the liability of loss in hardening, etc., and because of the extra expense of making one or two extra pieces to replace lost ones, it is more economical to start say 14 or 15 blanks, or enough to ensure more liability of having an extra piece than of lacking a piece at the end. When more than the ordered number happen to be carried along until the final operations, it is a small matter to finish them.

For some time these extra pieces were shipped to the customers. But so many returned the extra pieces with the bills, and requested that prices pro rata be deducted from them, it was found necessary to adopt the rule of throwing the extra pieces in the scrap heap and ship only the exact number of pieces ordered. Of course, if there is any difference in quality the best pieces are taken to fill the order. For a time an attempt was made to explain the reason for an occasional extra piece, but without success.

Now I think this can soon be changed by putting a proviso with each order. It might be stated that if it is thought best to start more than the number ordered, all the good ones finished will be accepted.

Or, if an exact number is not required, give instruction to start only a stated number and send what come out all right.

4. Among the yet unsettled things is how much information business courtesy requires to be given without its being paid for. An unknown man in Kansas or Kentucky writes to Philadelphia to learn how to proceed in calculating the change gears for a screw cutting lathe. In one of the railroad depots there is a Bureau of Information, but I have not heard that such a bureau has yet been established in any machine shop. Every business letter must be answered, and these letters of inquiry have generally been answered and the information given. Yet these questions are not always answered in the office, and the time taken might amount to quite an item in the ledger at the end of the year.

Considerable time may be given to answering questions relative to prospective orders.

I knew a question of shop ethics to grow out of answering a question of this kind. A prospective customer wanted to know the diameters to turn blanks for patterns for a train of two gears, he intending to send the blanks to be cut. Through a misunderstanding of his letter, a mistake was made in giving diameters. When the blanks came to be cut, the mistake was discovered. He was at once wired to make new blanks, and was told to charge them to the machine shop.

Now, in strict justice, who should have paid for these blanks?

Here I would like to say that not every business transaction between men in the mechanical world is decided by finely drawn lines. Acquaintances may be formed through business introductions, although there is a certain coldness necessarily running through all business. We book our name, the hotel clerk calls "Front!" we are shown to our room—all is perfectly easy and proper. In a few weeks, or months, perhaps, we return, the clerk calls us by name before we have registered; we feel complimented, but of what is really under that polite mask, we know nothing. We expect to form genial acquaintances at church, in social gatherings, at the club, in travel, perhaps. It is always very pleasant to be surprised by finding some new thing to admire in an acquaintance. But when we find, in a business acquaintance, thoughts running parallel to our own, and perhaps deeper and better thinking than our own, along lines that we love so well, we feel as one might, who, while groping, comes upon a gem which proves a speckless diamond. Invigorating, also, it is to deal with a man who will not hinge upon mere verbal mechanism, but will act upon the spirit to which both parties would have assented at the start. In the matter of the blanks, the man would not take pay for them. Before this I had never quite forgiven the city where he lived, for having to be entered in one direction through a dismal tunnel; but it is all right now.

To answer the question as to what are the merits of this case, we must go a little further back and ask what is the object of doing business? The answer will of course be to make money by legitimate means. Now, if there had been no mistake in giving diameters, and even if the man had sent the blanks elsewhere to be cut, the machine shop would have made no charge for the information. Hence, we would have a case where the main object of doing business is subverted, and if to this we add that the machine shop should pay for the blanks, we end in an absurdity. That is, we would be insisting that a risk be taken with no chance for remuneration. Still, I cannot help thinking that it was a pretty close case. A healthy pride would naturally restrain one from asking for any leniency after making such a mistake, but the merits of the case are in favor of the party who failed in making the calculations.

Since the foregoing happened, when answering any letter involving data, the proviso is made that the calculations are believed to be correct, but as no charge is made for them, no risk can be assumed in case they are found to be incorrect.

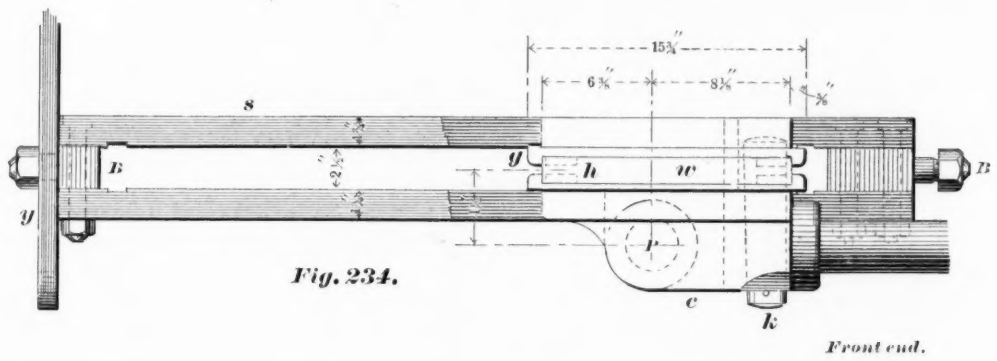


Fig. 234.

Front end.

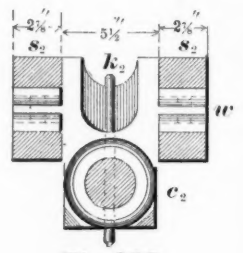


Fig. 235.

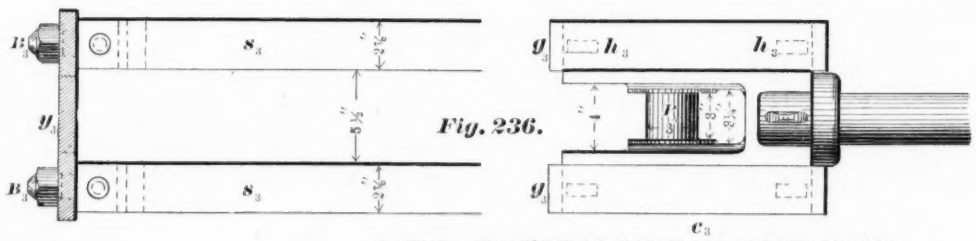


Fig. 236.

DESIGN SUITABLE FOR CAST IRON.

Cylinder 17″ diameter & 24″ stroke.

A matter of considerable importance to many American manufacturers and merchants is the proposed establishment of a parcel post between the United States, the West India Islands and Central and South America, admitting samples and other small merchandise parcels to the mails, without regard to the salable value of the contents. We hope the proposed agreements will be consummated.

Modern Locomotive Construction.

By J. G. A. Meyer.

FORTY-SECOND PAPER.

CROSSHEADS.

The function of a crosshead is to form a connection between the piston rod and the connecting rod, making the piston rod move in its true course, in a straight line, while the connecting rod moves through various oblique positions. Consequently we may say the crosshead consists essentially of a socket, to which the piston is keyed; a journal, on which one end of the connecting rod works, and, lastly, sliding surfaces, which are compelled to remain in contact with the slides, and thus guiding the end of the piston rod in its true course, preventing the thrust of the connecting rod from bending or injuring the former.

It will hardly seem necessary to give names to such familiar mechanism as here represented; but since the different pieces are not named alike by all mechanics, the writer deems it advisable to name the pieces, so as to avoid misunderstanding hereafter. Similar letters in the different views represent the same piece.

Figs. 234, 235 and 236. *S* represents the slides (some mechanics call these the slide bars or guide bars; we shall simply name these the slides); *B*, the slide blocks; *C*, the crosshead; *w*, the crosshead wings, or simply the wings (in some books these are called slides or slide blocks); *g*, the gibs; *P*, the crosshead pin; *k*, the crosshead key, and *y*, the guide yoke.

In locomotive construction three styles of crossheads are used, and these we may classify as follows:

First, crossheads which require four slides. Second, crossheads which require two slides. Third, crossheads which require one slide.

Fig. 234 represents a side view, Fig. 235 an end view, and Fig. 236 a plan of a crosshead and slides. This crosshead, as will be seen, requires four slides. This style of crosshead is generally used (not always) in eight-wheeled locomotives such as shown in Fig. 1, and ten-wheeled locomotives as shown in Fig. 3. When a crosshead is to be designed for one of these engines, we must keep in mind the following considerations. In the eight-wheeled and ten-wheeled locomotives the rear truck wheels are situated directly behind the cylinder saddle and between the slides and the frames, and these wheels must have a sufficient space for the lateral play when the engine is running over a curve. Now this space is limited by the position of the cylinders. Thus, for instance, the centers of the cylinders are always placed as close to the frames as possible, which, of course, will limit the space between the slides and frames and often give an insufficient space for the lateral play of the rear truck wheels. But since it is always of great importance to keep the centers of cylinders as close to the frames as can be done, we should not attempt to spread the cylinders so as to obtain sufficient space for the wheels, until all other resources fail. Now let us consider the distance between the center of the cylinders and the top of the track, and see if by some means sufficient room can be obtained for the wheels to pass underneath the slides and thus gain for them a sufficient space for their lateral play. In the first place, the centers of cylinders are usually placed

from 1 to 2 inches above the centers of driving wheels when the engine is in the ordinary good running condition.

The center of the crosshead pin *P* must of course remain in line with the center of the piston rod, or—what amounts to same thing—the center line of the cylinder; hence the height above the track to the center of the cylinder or the crosshead pin *P* will also to a great extent limit the space we wish to obtain. Now, only one more resource remains by which we may obtain the desired space, and that is, raising the slides above the center of the crosshead pin *P*. If this fails to give us sufficient space, then we must either spread the centers of the cylinders, or adopt a crosshead, as shown in Fig. 241, or do both. Usually it is found that a crosshead with the slides raised above the center of pin *P*, as shown in Fig. 234, will answer the purpose and still allow the center of the cylinders to remain as close to the frames as they can possibly be placed. This arrangement will enable the truck wheels to pass underneath the slides as far as will be necessary. Here the flanges have not entered into our consideration, and indeed it is not necessary, as there will always be, in this class of engines, sufficient space between the frames and slides for the lateral play of the flanges. In the near future we shall point out that sometimes in narrow gauge engines the side of the frames must be cut in order to clear the truck wheel. It must also be remarked that the engine and truck springs, particularly the latter, will cause the cylinders and slides to move up and down, and since the wheels have not this movement, a sufficient clearance between the under side of slides and top of truck wheel must be allowed, to prevent the slides from striking the top of truck wheels when the springs impart a vertical movement to the slides.

This style of crosshead is usually made of cast-iron, sometimes of malleable iron. The crosshead pin *P* and the crosshead are cast in one piece. The pin *P* is generally finished off by hand, sometimes with special machinery.

In order to take up quickly and readily any wear between the slides and the wings of the crosshead, the brass gibs *g* are introduced. The lips at the ends of these gibs prevent them from moving endways, and the lugs *h* cast to the gibs and fitting in the slots cut in the wing of the crosshead will prevent the gibs from slipping out sideways. When the wear is to be taken up, thin copper liners are inserted between the gibs and the wing.

Some master mechanics prefer crossheads with brass gibs, because, the brass being softer than the iron, they believe that there is not so great a liability to cut the slides as when cast-iron bears directly against the slides, which will be the case when crossheads without the gibs are used. Cutting the slides is always a serious matter, and if cutting does occur, it is always preferable that the gibs should be cut or ruined, rather than the slides, as the former are cheaper to replace, and replaced in less time (another important matter in railroading) than ruined slides. Yet experience also teaches that when slides are properly case-hardened, and crossheads without gibs are used, so that cast-iron bears directly against the slides, cutting of the slides is prevented by running a new engine, at first slowly and carefully, allowing the cast-iron wings to wear down, to smooth hard surfaces; after that there is little danger of cutting the slides, providing they are kept oiled. Consequently we meet with many locomotives in which the crossheads have no brass gibs and give perfect satisfaction.

Crossheads without gibs have the wings babbitted, as shown at *a a a* in Fig. 252. Three or more rectangular recesses, about ½ or ⅜ of an inch deep, ¾ of an inch wide, and as long as the width of the wing will allow, are cast in the wing, and then filled with Babbitt's metal. Sometimes as many recesses, ½ or ⅜ of an inch deep, 1½ inches in diameter, as there is room for, arranged in a manner as shown at *b b b* in Fig. 253, are bored in the wing, and then filled with Babbitt's metal. A few years ago these recesses were sometimes filled with glass disks. When these were used, the bottom diameter of the recess was larger than the upper diameter, and also the lower diameter of the glass disk larger than the upper one. This disk was then placed in the recess, and Babbitt's metal poured around it, and thus held firmly in the recess.

Objections are sometimes raised against crossheads with the pins *P* cast in one piece, as it is difficult to true up these pins when necessary, and therefore crossheads similar to that as represented in Figs. 237, 238, 239 and 240 are sometimes preferred.

This crosshead consists of several pieces. Fig. 240, *H* is a wrought-iron hub with fork end. This hub is keyed to the piston rod. The wings w_3, w_3 with flanges l_3, l_3 are made of cast-iron. The ferrule *F* is made of wrought-iron, case-hardened, the grain of the iron running around the ferrule, and not in the direction of its length; the fork end of the hub *H* is bored out large enough to receive the ferrule. The bolt o_3 is made of wrought-iron not case-hardened; the outer plate a_3 is made of brass and the inner plate b_3 of cast-iron. The purpose of the holes r_3 r_3 in the wing is to reduce the weight of the latter. Thin brass plates *d d* (Fig. 239) are riveted to the bearing surfaces of the wing, as shown. In putting this crosshead together the bolt o_3 (Fig. 240) is passed through the cast-iron plate b_3, through the wings, with the hub *H* and ferrule *F* between them. In screwing these together the wings w_3 w_3 bear hard against the ends of the ferrule *F*, and thus preventing the closing up of the jaw on the hub *H*. The brass plate d_3 is then fastened to the outer wing by two ⅝ screw bolts, covering up the nut of the bolt o_3 and giving a nice and clean outer appearance to the crosshead. The ⅝ screw bolt n_3 prevents the cast-iron plate from turning on the bolt o_3. The ferrule *F* forms the crosshead pin, and when it becomes worn, can easily be removed and replaced. This design makes a very good crosshead, but on account of its expense is not often used.

When crossheads of this kind or crossheads without gibs are used, thin copper strips are inserted between the slide blocks *B B* and the slides *S S* at the time the engine is being built. Then, when it becomes necessary to take up the wear between the slides and the crosshead, these copper slips are one by one removed, and thus bringing the slides together.

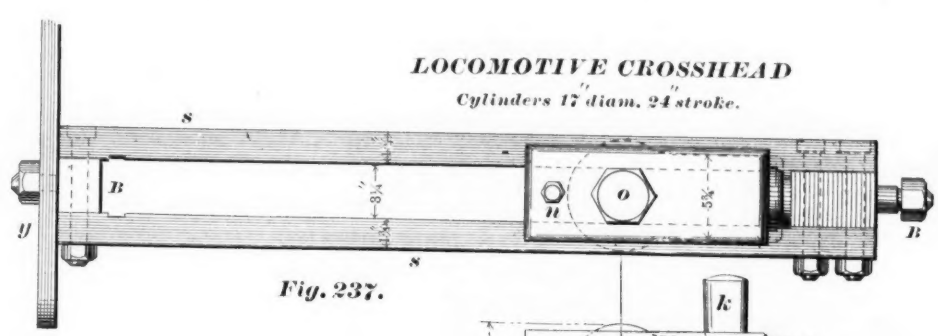


Fig. 237.

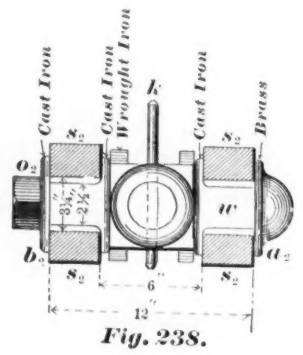


Fig. 238.

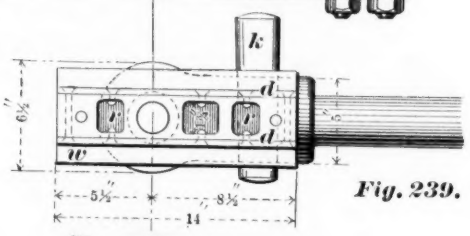


Fig. 239.

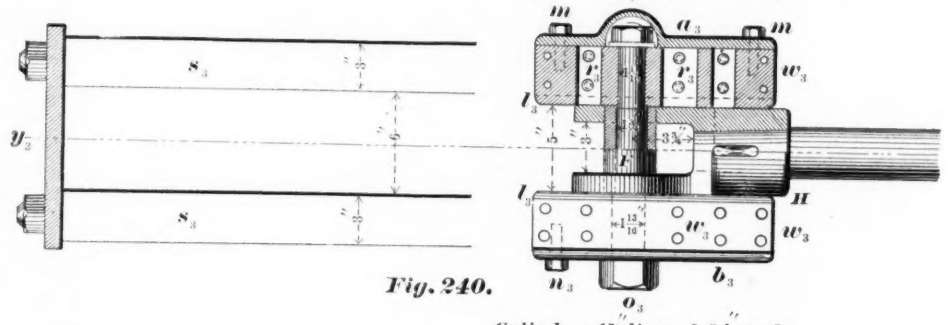


Fig. 240.

Cylinders 17" diam. & 24" stroke.

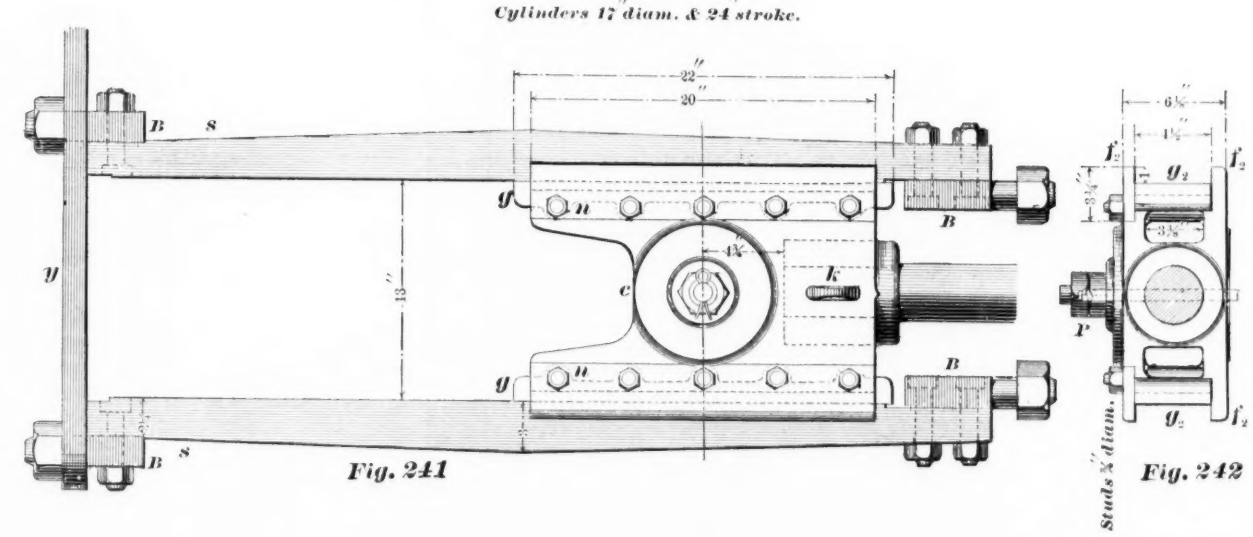


Fig. 241

Fig. 242

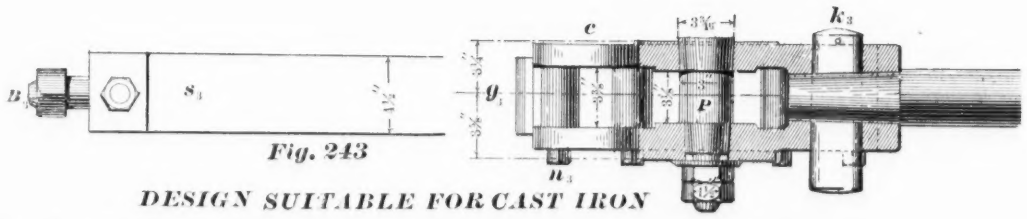


Fig. 243

DESIGN SUITABLE FOR CAST IRON

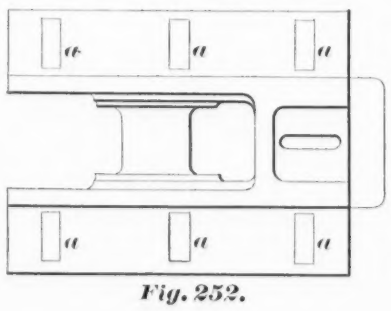


Fig. 252.

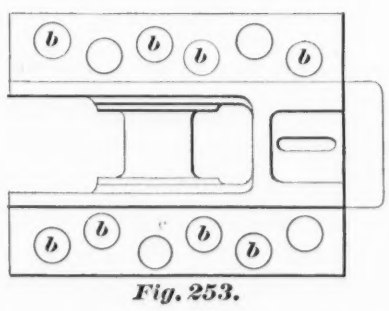


Fig. 253.

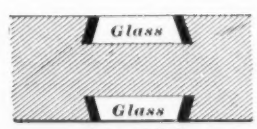


Fig. 254.

Herr Schiller, a German architect, as the result of observation concludes that a lightning rod will afford protection to a distance around it equal to twice its height.

Application of Mariotte's Law.

In connection with the answer to question 288 this article will be interesting and profitable to the reader. It is sometimes required to make a gauge which shall indicate the pressure of compressed air. When such is the case, the question often arises, how can we find the distances between the graduations? The purpose of this article is not to describe the gauge in all its details, but simply to show how the scale for such a gauge can be constructed, or in other words, how the graduation on the scale can be found by the application of Mariotte's law.

The law of the compressibility of gases was discovered by Boyle in 1662, and afterwards independently by Mariotte in 1679. Consequently the law is sometimes called "Boyle's law," and often "Mariotte's law." It is as follows:

The temperature remaining the same, the volume of a given quantity of gas is inversely as the pressure which it bears. Or we may state it thus: The volume of a confined mass of gas is inversely proportional to the pressure to which it is exposed; the smaller the pressure, the larger the volume, and the greater the pressure, the less the volume.

When air is compressed its temperature will be increased, and consequently its pressure will also be increased, therefore if a very accurate scale is required, the temperature should be taken into account. But often in practice, a scale in which the temperature is not taken in account is considered sufficiently accurate. We will therefore, for the sake of simplicity, neglect the increase of temperature of the air in the following calculations

In order to aid us to obtain a clear conception of the application of Mariotte's law to practice, let us take the following example.

It is required to construct a scale which shall indicate the amount of compression for every increase of one pound pressure. The scale is to be 30 inches long; the temperature of the air is assumed to remain the same during compression.

In the illustration let T represent a tube whose area is just one square inch, and bored out perfectly true; P a piston fitting accurately in the tube so that the piston can move up or down, and yet prevent any leakage of air; C, an air-tight chamber; F, a fulcrum, and L a lever working on the fulcrum F; the arms of the lever are of equal lengths; w, a weight to balance the weight of the piston and rod, and W a weight to balance the pressure of the air. The friction of the piston in the tube is assumed to be so small that it can be neglected without an appreciable error.

Now assume that the piston is placed in the tube in a position as shown in the illustration, and perfectly counterbalanced, so that the distance between the top of piston and top of inside of tube is 30 inches. In placing the piston in this position the hole H in top of tube should be left open, and after the piston is in position close the hole H by the set screw, as shown. The space in the tube above the piston is now filled with air.

Assume now that the air is being pumped out of the chamber C, then, in order to keep the piston in the position shown, the weight W must be placed in position, small at first, to be sure, and increased as the space in the chamber C approaches a perfect vacuum; and when a perfect vacuum has been obtained, the weight W will be found to be equal to 14.7 pounds—for the sake of simplicity we will call it 15 pounds. This weight W indicates that the pressure of the air in the tube tends to press the piston into the chamber C, and the force exerted by the air to force the piston out of the tube is 15 pounds. Here, then, we have a volume of air of one square inch, and 30 inches long, exerting a pressure of 15 pounds. This condition will be our starting point, or the basis on which the following calculations are based. If now the piston is moved upwards to within 15 inches of the top of tube, so that the volume is compressed one-half, then, according to Mariotte's law, the pressure must be doubled; that is, it must be equal to $15 \times 2 = 30$ pounds. This pressure can be found by the simple rule of proportion, thus: 15 inches : 30 inches : : 15 pounds : pressure. Here we multiply 30 inches (the height of the scale) by 15 pounds (the original pressure), and divide by 15 inches (the distance of piston from top of tube); the answer (30 pounds) is the pressure of the air when compressed into this space. Or, writing this operation in a manner which will show at a glance what has been done, we have:

$$\frac{30 \text{ inches} \times 15 \text{ pounds}}{15 \text{ inches}} = 30 \text{ pounds pressure.}$$

If we again move the piston upwards to within $7\frac{1}{2}$ inches from top of tube, we again compress the air one-half, and therefore according to Mariotte's law the pressure when the piston is in this position must be 60 pounds, that is $30 \times 2 = 60$ lbs. But this answer can, as before, be found directly by simple proportion, thus:

$7\frac{1}{2}$ inches : 30 inches : : 15 pounds is to the pressure, or

$$\frac{30 \text{ inches} \times 15 \text{ pounds}}{7\frac{1}{2} \text{ inches}} = 60 \text{ pounds pressure.}$$

In a similar manner, we can find by the rule of proportion the pressure of the air compressed to any portion of the tube, thus:

(The distance from the top of tube to top of piston) is to (length of scale in inches)

as (one atmospheric pressure) is to (the pressure required.

Or, putting this rule in the shape of a formula, we have:

$$\frac{\text{Length of scale in inches} \times \text{one atmospheric pressure in pounds}}{\text{The distance in inches from the top of tube to top of piston}} = \text{pressure of air in pounds required.}$$

If we have the pressure given, as is the case in our example, we reverse the above rule; hence, to find the distances of the graduations from the top of tube, we have:

$$\frac{\text{Length of scale in inches} \times \text{One atmospheric pressure in pounds}}{\text{Given pressure of air in pounds}} = \text{distance of graduation from top of tube.}$$

Therefore the graduations on the scale in our example will be

$$\frac{30 \text{ inches} \times 15 \text{ pounds}}{16 \text{ pounds}} = 28.125 \text{ inches.}$$

This answer is the distance of the first graduation from the top of tube.

$$\frac{30 \text{ inches} \times 15 \text{ pounds}}{17 \text{ pounds}} = 26.470 \text{ inches.}$$

This answer is the distance of the second graduation from the top of tube.

In a similar manner all the graduations on the scale are found. The distances between the graduations will rapidly decrease towards the top of scale.

Tests of the Comparative Value of Different Kinds of Belting.

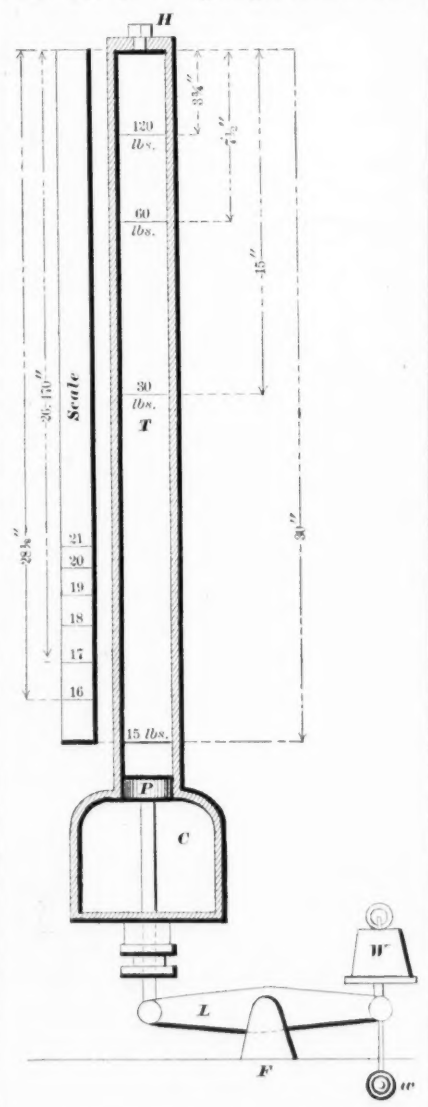
Samuel Webber presented a paper with the above title at the Washington Meeting of Mechanical Engineers. The paper is mainly a description of the the tests made, given in the form of tables. Mr. Webber's experiments led him to settle upon the following formula for belts:

$$\text{Width in inches} = \frac{\text{No. H P.} \times 33000 \times 180^\circ}{\text{Vel. in ft. per min.} \times \text{strain in lbs. (per inch width)} \times \text{arc of contact}}$$

and H P.=

$$\frac{\text{Vel in ft.} \times \text{strain per in.} \times \text{width} \times \text{arc of contact.}}{33000 \times 180^\circ}$$

In discussing this paper, Mr. Dutton said the paper of Mr. Webber was so severe on the link belt that he desired to instance an illustration from a different point of view. He said: In the shops with which he was connected we had occasion to run a cross shaft some distance, to drive a 60-inch lathe. The pulleys were about 36 inches in diameter, and the shafts perhaps 15 feet apart. The ordinary belt used for this purpose strained out very rapidly, so that we had great difficulty in driving it. The link belt was recommended, and was put in on trial, and has proved satisfactory. It was a 5-inch belt that we used. I think two sets of links were taken off, after running two or three weeks; but now, for two or three months, the belt has run entirely satisfactorily, requiring no further attention, so for that purpose the same width of belt as was used before has been entirely satisfactory, while the ordinary belting was very unsatisfactory. Those of us who are interested in motive power would be glad to see experiments with larger belts and considerably higher speed than these. In running at very high speeds with very small pulleys, there seems to be difficulty. I remember an instance in which we ran a 12″ double belt, running over a 6-foot pulley, running 300 revolutions, and over a 30 inch, perhaps 15 feet from that, or 12 feet, directly above, in which a large portion of the way around the pulley, by bolding a light on the further



Application of Mariotte's Law.

side of it, you could see the light between the pulley and the belt, notwithstanding the belt was drawn up pretty tight before commencing.

Mr. Towne thought it difficult to cover all the points in an ordinary set of experiments. He had found in experiments he made 20 years ago that the condition of the atmosphere was a large factor in the transmitting energy of leather belts. Leather was a capital hygrometer; it measured the dryness or the moisture of the atmosphere with great delicacy. Any critical and conclusive series of tests of belting, at least of leather belting, must be continued through a long enough period of time to cover the average range of variation in the weather to give perfect results: He said:

A leather belt, well made, certainly holds very high rank, if not the highest rank as a power transmitter, and yet here the results would indicate rather the contrary. A new leather belt is stiff, inflexible, does not readily adapt itself to the pulley, and has a peculiar quality of surface which we all recognize by the touch, and which is much less conducive to adhesion than the surface of the belt after it has been run for some time, and has been treated with the ordinary dressing. Therefore, to institute a comparison between a leather belt which requires this preparatory use and treatment, in order to bring it to its full efficiency, and another belt, like a rubber belt, which requires no such preliminary preparation, and had its high efficiency when first put on, is deceptive. The leather belt should be run long enough to bring it up to its maximum efficiency.

* * * Finally, no formula, I think, can be accepted as universally applicable to belts, whether horizontal or vertical. The stretching becomes of much more consequence in the case of a vertical belt than in the case of a horizontal belt.

Mr. Scott thought each belt maker should publish tests that were reliable in regard to the belts he makes. They got different kinds of belts from the same house, and almost from the same roll. A dozen poor belts and one good one were had from the same house.

Mr. Towne: Referring to the carrying of air between the belt and the pulley at high velocities, I would say, that in a paper by the late Robert Briggs, published in the Journal of the Franklin Institute for Feb., 1868, Mr. Briggs threw out the suggestion that the entrainment of air between belt and pulley might be a factor of importance in the transmitting power of belts at high velocities, and suggested that it could be remedied, in part at least, by putting a stripper close to the pulley and between the pulley and the belt, in such form as to strip the air carried along with the belt, off from the belt as it passed along the pulley.

Mr. Underwood made a sketch on the blackboard of a hide and said:

There is the tight side running through the hide in the center; there is also a tight side running where the flank comes up and stops. Now most belt makers have an idea that if you want a four inch belt, you must split that hide right through the middle. That is not right. The only place you can take it from and have it run perfectly true, is two inches each side of the center, but no manufacturer could afford to make belting and sell it at the price which they have to, and take it in that way. That is the reason why you have trouble in getting different kinds from one manufacturer, as you cannot pay him enough.

Here is a capital idea and there's good wages in it: A citizen is traveling about uptown, accompanied by a frame scales, swing platform, and a stout barrel in a go-cart pushed by his laboring man. Whenever he sees a dump of coal on the sidewalk he walks to the basement bell and seeks the job of weighing the black diamonds before they are stowed away in the cellar. He balances his beam to the weight of the platform and barrel, and then his man fills the barrel; he weighs it himself, and so on until the whole pile has gone through the scales. He then gives a signed certificate and receives his fee of 40 cents a ton. If the first cartload weighed turns out O. K. the customer is generally satisfied that the whole consignment is correct. A good many people are perfectly willing to pay the small fee demanded, just for satisfaction. If the weigher is noticed by the coal cart driver it may be guessed that his subsequent deliveries will be all right to an ounce. Any citizen a resident of the city and of good moral character may go into the weighing business without license, and his sworn certificate will be accepted as evidence in court.—*New York Times.*

So far as we have observed nearly every New York daily has printed what appears in the beginning to be an interesting article on "Magnetism and Watches," but before the conclusion is reached turns out to be an advertisement of a watch of which it is

alleged that it cannot be magnetized. We say nearly every New York daily, because if there is one that has not printed this item it deserves a free advertisement.

Testing Water Wheels.

President Babcock told a good story to the Mechanical Engineers at Washington about two young men whom he once knew—twin brothers, named Brown. In infancy they were literally cradled by water-power, their ingenious and shifty father having contrived a small water-wheel arrangement for the purpose of rocking their cradle. Just how much cradle-power this required will perhaps never be accurately known. Owing to this circumstance the brothers, naturally enough, as they grew to manhood, gradually came to regard themselves as mechanical geniuses of the first water (power).

Having invented a water-wheel, they undertook to make a test of its relative value, as compared with another wheel in market, Kit Stillman's, the only one with which they were familiar, and the test was concluded to their entire satisfaction. They announced with pardonable pride that their wheel had given 13½ per cent. better results than Stillman's.

Being asked particulars regarding their method of testing, one of them explained that they made small models representing the two wheels of exactly the same size, and put in penstocks giving exactly the same head of water.

Then, to make sure that they used the same amount of water, they measured the water that came through, with a pail, and weighed it.

Then they took the spindle of one wheel in one hand, and the spindle of the other wheel in the other hand, and "as nearly as they could judge," the model representing their invention produced 13½ per cent. better results than that representing the wheel which was being palmed off upon a too confiding public!

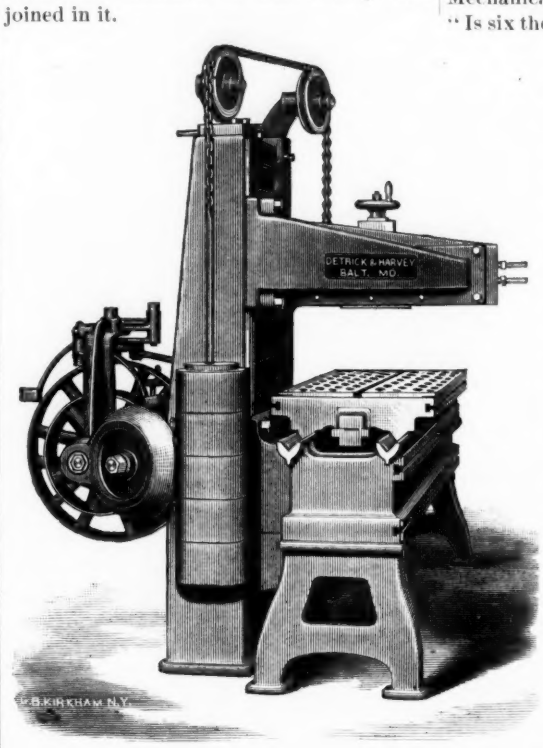
We commend the details of this method of estimating power to some of the manufacturers who have not been satisfied with the figures derived from other and less ingenious methods.

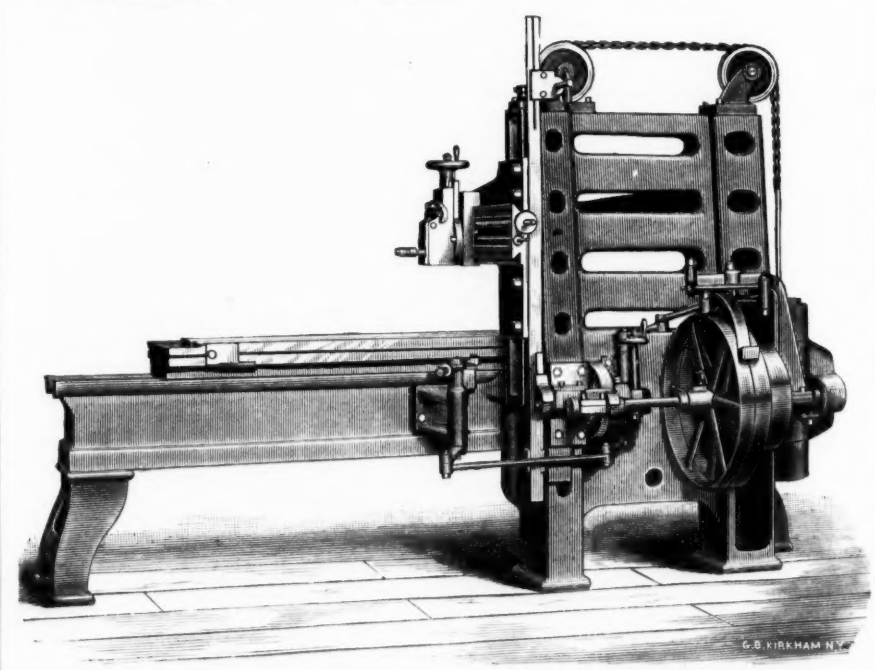
Melting Iron with Natural Gas in Place of Coke.

A practical test of the process lately devised by Col. A. J. Sweeney for melting iron in a cupola with natural gas as fuel, was made on last Tuesday afternoon at Sweeney & Son's foundry, Wheeling, and the experiment was an entire success. The cupola was charged with 3,500 pounds of pig, and in about three minutes after the blast was put on the metal began to drop, and in forty minutes the whole batch was melted. Not an ounce of coke or other material to "sustain burden" was used, nor is it necessary.

The pigs of iron lie immediately on and in contact with the bottom of the cupola. The iron poured nicely, and it is claimed for the process that the freedom from sulphur will make a much purer iron than can be secured with coke. The process is applicable to cupolas in steel plants, and any process which requires the melting of metal. All witnesses of the test pronounced it a sure enough thing.—*Labor Tribune.*

Mr. C. J. H. Woodbury and a number of other gentlemen have united in the purchase of three large bronze vases from the executors of the late J. C. Hoadley, and presented them to the Boston Art Club. The vases were modeled in Italy by the late Horatio Stone, sculptor for the United States Government, and intended for the decoration of the rotunda of the Capitol at Washington, under an appropriation made by Congress in 1870 for that purpose; but when the vases were finished some years later, owing to an informality, the amount appropriated ($10,000) had reverted to the government, and there was no warrant in the treasury department authorizing the expenditure. Subsequently Mr. Stone sold them to Mr. Hoadley. The largest of the vases, which is about five feet in height, represents the two great events in the history of the republic—its inauguration in 1789, with numerous historical figures of that period, and the preservation of the republic at the termination of the great rebellion—by representations of the great names connected with the events of that time. The other smaller vases contain symbolic representations that make them also interesting as studies and beautiful as works of art. The free hospitality of the Art Club towards the American Society of Mechanical Engineers at their Boston meeting receives in this presentation a handsome acknowledgment from some members of that society who joined in it.





OPEN-SIDE IRON PLANER.

Open-Side Iron Planer.

The accompanying illustrations represent a 25″ by 6 foot machine of this type, made by Detrick & Harvey, Baltimore, Md. Since this line of tools was first brought out by the manufacturers the increasing demand has induced the manufacturers to make such changes as experience dictated, the present engravings representing their latest practice.

A feature which greatly increases the capacity of these machines is the removal of the cross-beam and the placing of the tool box and saddle on the post, giving in the 25″ machine a vertical movement and feed of 28″, in the 30″ of 40″, and in the 36″ of 45″. A supplemental rolling table which moves simultaneously with the planer platen supports the outer end of extra wide and heavy work.

It will also be readily understood that a great variety of work that would require a very large two-post planer can be readily done on a comparatively small machine of this type.

When desired a special tool box and saddle can be furnished for the post which may be used along with the regular tool box on the cross-beam.

For driving these planers the builders have adopted the Sellers spiral planer motion, which for power, simplicity, durability, and smooth running qualities, is familiar to the mechanical world.

Safety of Stay Bolts.

In the discussion at Washington, by the Mechanical Engineers, of topical question 43, "Is six thousand pounds per square inch, as United States inspection laws provided in the for steam vessels, a necessary limitation for stays in marine boilers?" Mr. Stirling thought one very good reason for this limit was the difficulty of arranging the pressure on each stay of a flat surface so that each stay should have its proportion of work to do. He did not, however, see any good reason for limiting the strain on stays to 6,000 lbs., while allowing 10,000 lbs. or 12,000 lbs. on the shell. The giving way of a shell in a large marine boiler would be more disastrous than the giving way of a stay; and we should not conclude without investigation that the strain should be less on the stays than on the shell.

Mr. Stratton said the rule had always seemed to him extremely arbitrary. Many parts of boilers are inaccessible—also, in some cases, the boiler stays: but as a general thing boiler stays are accessible, and are taken out, examined and repaired. He therefore saw no reason for placing the limit at 6,000 pounds.

Mr. Kent thought there might be one reason—the effects of internal corrosion. A shell reduced in thickness by internal corrosion one-tenth of its original thickness was much less injured than a stay surrounded by water on all sides, and corroded to the extent of one-tenth of its whole thickness, which would be, not 10 per cent., as in the case of the shell, but 19 per cent.

Mr. Walker said that every engineer had seen stays almost gone while the shell was perfect.

Mr. Stratton argued that the question then resolved itself largely into one of inspection. If inspectors were half as particular in examining the stays as they are in examining the external portions, these difficulties would very frequently be eradicated. The shell contains the entire volume of steam and water. The stay is not as important as the shell.

Water Better than Bullets.

New uses for water are being discovered constantly. Some people are even finding out that it is good to drink. As it seems that the employment of armed forces in industrial disputes has not yet entirely gone out of date in this country, it is well to have the resulting havoc made as light as possible. In a recent dispute at Waterford, N. Y., between a railroad company and the village authorities about a question of laying tracks in the street, the authorities called in the aid of the fire department. The Italian laborers employed by the railroad company were promptly routed and driven from the field by streams of water directed at them through hose pipes attached to convenient hydrants. Unhappily it does not seem to have occurred to anybody that a judicious preliminary would have been the dissolving of a quantity of soap in the reservoir before turning on the water.

Some day it will be discovered that a good way to subdue street mobs in cities will be to call out the fire department armed with nozzles, instead of the military armed with rifles.

L. H. Rutherford, of New York, presented a paper at the Mechanical Engineers' meeting under the caption: "Should a Piston Ring be of the Same Thickness at Every Point?" This paper was read in abstract by Secretary Hutton. Mr. Rutherford's calculations tended to show that uniformity of section was not desirable. In the discussion of this paper, Mr. Porter said:

I believe that the piston ring, acting by its own elasticity, was first employed by Mr. Ramsbotham, the well-known superintendent of the London and Northwestern Railway, some 25 years ago. His ring was a parallel ring of equal depth all around, and it was a wrought iron ring. I used them myself with very poor results; they wore very unequally, so that I ceased to use them, and used a cast iron ring which I always bore eccentric.

C. E. Emery said: Some 20 years ago in one of the large mills of the country, I found that they had been using brass rings, and it took 1,500 horse-power going through to get 700 horse-power actually. By taking them out and putting in cast iron ones, and making them true in the back, the engine started up with a greatly diminished consumption of fuel.

Power Required to Drive Machine Tools.

In the course of the discussion upon Henry R. Towne's paper before the Mechanical Engineers, entitled "Methods of Determining Cost and Distribution of Heat and Power," President Geo. H. Babcock said:

At the last meeting one of the topical inquiries was "How Much Power Have you Found it to Take to Drive Machine Tools?" We have described in Mr. Towne's paper a machine shop of some size, and we have indicated horse-power. There is no assumption about it. You will find in the paper that the total horse-power required to drive the shop is 135.05; while the horse-power required to drive the shafting, blowers, and such things as are not machine tools is 66.81; leaving 68.24 horse-power to drive the machine tools. Somewhere in the paper it is stated that 700 men were employed. You will see that is a little less than a horse-power for ten men, which was the estimate I gave roughly at that time.

A friend of ours lately got into a lively discussion in a parlor about the relative importance to society of great statesmen and great mechanics. "Pshaw!" said our enthusiastic friend, "the real work of the world is done by the mechanics and the farmers, who are also mechanics in their special sphere. Politicians and warriors are merely policemen, whose business it is to keep order while the mechanics and the farmers do the work!"

LETTERS FROM PRACTICAL MEN.

Steam Fire Engine Boilers.

Editor American Machinist:

I notice in your issue of June 18th Mr. Harrison speaks of Amoskeag boilers lasting only four years. We have one in this department which has been in service eleven years without a cent in the way of repairs. It is a steel boiler with copper tubes, and as far as I can judge, without taking it apart, it is good for eleven more years of service. Of course, if taken apart it might be found in poor condition, but there is no visible evidence that this is so; it works just as well as when new.

Regarding the use of oil, I use crude petroleum in the boiler referred to, and find no trouble whatever from its use. On the contrary I find good results. I put one-half pint in the highest part of the boiler, let it stand a half-hour and draw off all the water. I then put in another half-pint, fill the boiler full and draw down to two gauges. I have never been troubled with foaming, no matter how hard I work the engine; I carry the water as high as if no oil was used.

A fire engine boiler is very compact, there being only three-quarter inch water space in the leg. You cannot run a rod around in this space to remove the scale, but I find that the oil softens the scale so it can be blown out of the leg. Soon after I began using the oil I could see that the boiler steamed much more freely. It seemed, by removing mud and scale, to make a new boiler of it.

Some argue that with the rapid circulation in these boilers no scale is formed. I know there is, for since using the oil I have taken out a great deal, and every handful you take out the better the boiler steams. This is very important in steam fire engine boilers, which, from the nature of the case, are small for the work.

I think if crude oil was used with a new boiler there would be no corrosion, for the reason that the oil coats the iron with a greasy surface, to which no scale will adhere.

Wm. H. Bradt,
Engineer Arba Reed steamer, Troy, N. Y.

Graphite in Steam Cylinders.

Editor American Machinist:

I read in a recent issue of the American Machinist your article relating to the use of graphite in steam cylinders. I find by looking in the dictionary that graphite is another name for black lead. I have been using that in cylinders for several years; I think it the best lubricant for valves and pistons at any time, and particularly when there is water present. I use it with tallow or cylinder oil, feeding it through a common oil cup. In using tallow I first melt the tallow, and then mix in the lead.

B. W. Benson.

Drilling Chilled Castings.

Editor American Machinist:

If N. M., who inquires how to drill chilled castings, will heat that part that he wishes to drill to a red heat, burn on the point to be drilled a piece of roll sulphur as large as a walnut, and let the casting cool slowly, he will anneal the piece.

C. D. Rathbone.

Making Blue Prints Without a Glass Frame.

Editor American Machinist:

I have just been reading an article describing the Cleaves process of making large blue prints, as presented before the Mechanical Engineers Society by Prof. R. H. Thurston, the scheme involving a cylinder of sufficient dimensions to stretch the tracing and sensitized paper upon. I had often thought that if I ever had a large blue print to make, I should try to print it by rolling the paper together, so upon reading this article I took a sheet of sensitized paper 18″x23″ (not having any larger on hand) and a tracing of same size, laying them together as for printing in a frame, rolled them into a tight roll, then I took the roll out in the sunlight and commenced rolling the end of the sheets under and into a new roll, exposing the paper to the sun as I slowly wound the paper on the new roll and off the other. As this was done without anything to prevent slipping of the paper, and with no previous experience, the result was not entirely satisfactory, but the print would be considered good enough for a patternmaker to work to. I then procured two sticks some ¾″ in diameter, and tacked a tracing and also a sensitized sheet to one of these rollers, then winding the sheets tightly on the stick, the loose ends were tacked to the other stick and the exposure was made by winding from one stick to the other. This print was more satisfactory, although slightly streaked. I send you both prints, that you may see results, although I made but the two prints, business allowing me but little time for experiments. I am satisfied that prints of any size can be successfully made in this way, without the expense and trouble of a large cylinder, and without regard to the length of the sheet. I have no use for larger prints than our standard size, 22″x30″, but for any one using larger I would suggest a frame with rollers as per sketch, with a strip fastened between them as shown, for the paper to draw over. If one was using sensitized paper in a continuous roll a modification, as shown at Fig. 2, might be better. The prepared paper could lie in a box on roller *a* and be drawn through a narrow slit, then meeting the tracing from rollers *b* and by slowly turning roller *c* the print could be taken with very little trouble.

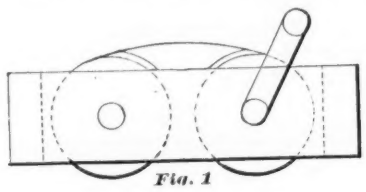


Fig. 1

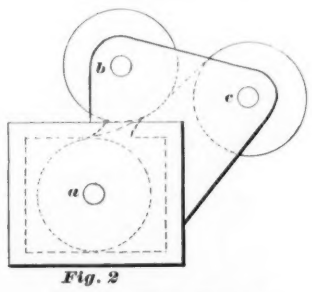


Fig. 2

Making Blue Prints.

E. J. Armstrong.

[The blue prints taken in this manner, and sent to us as a sample are very good, and clearly indicate that with paper properly prepared, and with a little care, excellent blue prints can be made by this method; in fact, we believe that these blue prints will be as clear as any made with a glass frame.]

New Odontograph.

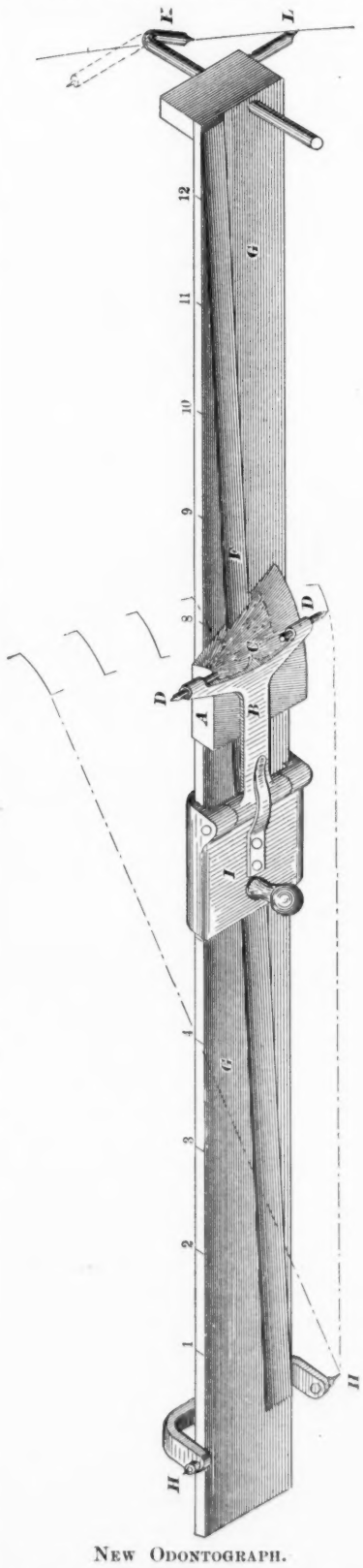
Editor American Machinist:

The illustration represents an odontograph which I believe to contain some new features and may be of practical value to draftsmen and patternmakers. It is not patented, nor do I intend to apply for one, leaving any one of your readers at liberty to make one and use it. I have made a rough wooden model that I find—in spite of its poor workmanship—to work pretty well for constructing the form of teeth whose sides correspond to the involute curve. *I* in the illustration represents a slide moving easily on the straight edge *G G*, and carrying the hinged cross-shaped lever *B* with the pencil *D D*, and the guide point *C*, which is—by means of a spring—pressed against the block *A*. The outer surface of the block *A* is a curved surface, similar to a conical surface, but correctly shaped, so that when the guide point *C* slides along this surface, the pencil point *D* will describe the correct form of tooth. The block *A* is made to move along the diagonal rail *F*, the former being dovetailed with a sufficiently tight fit not to shift out of position by the friction between the guide point *C* and the outer surface of the block *A* during the time the former is moved along the latter to describe the side of the tooth. *H* is the center of the wheel to be constructed. It will be seen that in setting the block *A* to any given distance from the center *H*, the diagonal rail *F* will adjust the block *A* vertically, that is, it will give the block *A* such a relative position to the guide point *C* which will cause the pencil *D* to describe the right curvature of tooth corresponding to the radius *H D*. The formation of the tooth is therefore entirely automatic. For drawing the other side of the tooth the instrument is reversed. On the outer end of the instrument there are two needle points, *L* and *K*. The point *K* is adjustable, and is set to suit the pitch.

If instead of making the block *A* solid, we build it up by a number of thin steel plates, we obtain by separating them a number of templets for different radii, that might be handy in the drawing room or pattern shop.

H. Fladvad.

Superintendent Small, of the Pavonia Horse Railroad, Jersey City, N. J., has invented and is using a peculiar arrangement for breaking in mustangs for horse car purposes. It consists of a large circular structure, about 100 feet in diameter. The top



New Odontograph.

of it is a circular railroad, and pendant from the rail there are a number of swing sticks, with a ring in the bottom, and a wheel which runs on a center bearing rail overhead. The mustangs are hitched to an apparatus at the end of the rings, and are driven around a circular track until they learn to go steadily on all fours.

Twenty-First Annual Convention of the Master Car Builders Association.

The Master Car Builders began the sessions of their twenty-first convention at Minneapolis on June 14.

In his address of welcome Mayor Ames spoke highly of the benefits arising from organizations such as the Master Car Builders. Such organizations, he said, developed the perfection of the world. It was the gathering of such minds that materialized the rough stones into monuments of time. He was a railroad surgeon, and the cars from the East did not fit the cars from the West, and this brought him lots of business, but he wanted it changed.

The President in his annual address combated the idea that railroad managers were careless of the lives of their employes. He thought they were willing to try new inventions that promised greater security to life. Railroad employes were proverbially careless, and would not always make use of safety appliances when provided.

Secretary Forney's report was, as usual, very complete and satisfactory.

Following are the committees announced by the president:

On nominations—Robert Miller, Detroit, Mich.; C. A. Smith, Jersey City, N. J.; George Hackney, Elizabeth, N. J.; J. N. Barr, Milwaukee; George F. Wilson, Minneapolis.

On subjects for investigation—Joseph Wood, Fort Wayne, Ind.; William McWood, Montreal, Canada; E. B. Wall, Columbus, Ohio.

Correspondence and resolutions—L. G. Matthews, Jeffersonville, Ind.; J. C. Barber, Brainerd, Minn.

To select place for next annual meeting—W. F. Turreff, Cleveland, Ohio; H. Wilbur, Bethlehem, Pa.

The Brake Committee's report was very complete and exhaustive, showing hard work by the committee. One of the conclusions of this committee was:

We believe, from what we have seen at the Burlington brake tests, and from close personal examination of the several electrical arrangements for braking, that electricity, properly devised and managed, may be made a valuable auxiliary to actual power brakes on long trains, and their efficiency considerably increased thereby.

The Committee on Automatic Freight Car Couplers handled the subject well. The following, from their report, fairly illustrates their conclusions:

Railroads have reached a point where there is an absolute need for an automatic train coupler; it is vividly apparent that a coupler must be introduced to save the life and limb of the employes; decrease the cost of operation by enabling the use of power train brakes; to do away with the shocks of stopping and starting, and to eliminate the damages of bunching trains in sags and hollows. The public demand it; the safety of the trainmen demands it, and the economical operation of railroads demands it. Already several corporations are acting, and more, some of them very large, are getting ready to act this year; the urgency is great, and will not brook delay. If we do not agree upon some course, we will be reprehensible, for it is only by this association that uniformity can be established in order that all of the lives and limbs which it is possible to save will be saved; that all the benefits in operation that it is possible to achieve will be achieved. If we do not secure this uniformity, who will be responsible for the extra risk which comes to trainmen when two odd couplers on a home and foreign car are brought in conjunction? who will be responsible for the extra cost of operation that such a condition will entail? This association. The fruit is now ripe, and if you do not pick it, it will be soiled, for next year numberless complications arising from the introduction of miscellaneous couplers, will lose this association in a mess from which we will never be able to rise, and our opportunity to serve our fellow-men and our companies will be irrevocably lost.

In view of the facts already mentioned, that the best type of coupler is still undergoing development in matters of strength and simplicity, and that many railroads are not ready to adopt it until it is better perfected, your committee would further recommend the continuance or use of the Marks, Ames and McKeon couplers as the best representatives of the loose couplers.

The following officers were elected for the ensuing year:

President, William Wood, of the Grand Trunk, Montreal; vice-president, J. W. Cloud, of the New York, Lake Erie and Western, Buffalo; E. W. Grieves, of the Baltimore and Ohio, Baltimore; John S. Lentz, of the Pennsylvania and New York Canal and Railroad Company, Packerton, Pa.; treasurer, John Kirby, of the Lake Shore and Michigan Southern, Cleveland; Executive Committee, Joseph Wood, of Fort Wayne, Ind., R. D. Wade, of Richmond, and F. A. Bissell, of Buffalo.

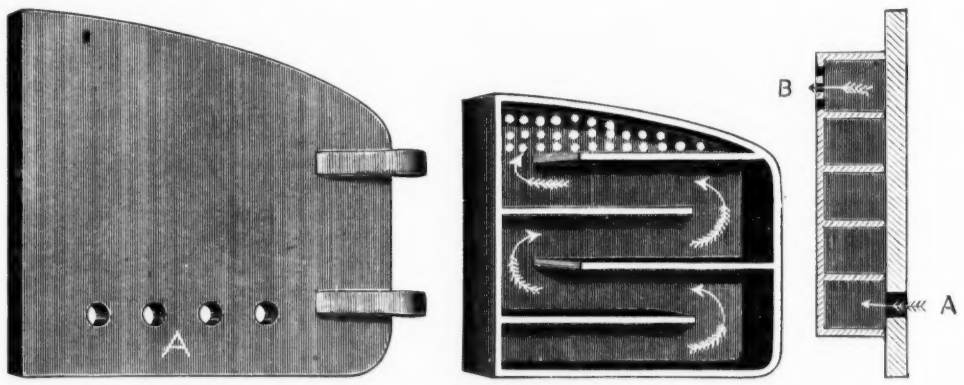
Fluorspar in the Iron Furnace.

Mr. B. Burbank of Evansville, Ind., interested in mining fluorspar, believes that substance, containing, as shown by analysis, 51.87 parts calcium and 48.13 parts fluorine, can be used successfully in the furnace in iron manufacture in place of limestone, of which latter from one-third to one-half as much as of ore is frequently required. Limestone is not equal to fluorspar as a flux, the latter fusing at a much lower temperature. Of course the spar could not be applied on top of the ore, as limestone is, but should be applied in a crushed condition and injected through the tuyeres by the aid of a blast, with the result that a much smaller quantity would be required, while its use, it is claimed, would afford a cleaner, quicker and more fluid melt and a better quality of iron. The space in the furnace now occupied by the large quantity of limestone required, and the crevices between the lumps of ore, could of course be more fully utilized. In applying the fluorspar an elevated reservoir should be constructed, striking the blower pipe obliquely by means of another pipe with flow regulated by a valve, thus communicating readily with each of the tuyeres.

We believe no trial of this substance has yet been made for this purpose, but undoubtedly trial will be made.

The Eureka Hot-Air Furnace Door.

This is an improved furnace door, the object of which is to save fuel, and to preserve the door from the destructive effect of intense furnace heat.



EUREKA HOT-AIR FURNACE DOOR.

The beneficial results of the judicious introduction of hot air are quite generally acknowledged, and the construction and arrangement of this door present some novel features. As will be readily understood by the engraving, the air is first drawn into the hollow space between the iron door and lining; the quantity of air permitted to enter is controlled by a slide which is not shown in the engraving. The air thus admitted is caused to flow back and forth across the width of the door in a course indicated by the arrows; and finally, when at a very high temperature, is injected into the furnace above the fire through a series of minute apertures drilled in the upper part of the door liner.

It will be seen that while the air may enter the space divided by the diaphragms at a low heat, it constantly rises in temperature until the instant of its contact with the expanding gases of the furnace, it is ready to chemically combine with them and promote combustion.

It does not require argument to demonstrate the advantage arising from a regular circulation of air between the inner and outer walls of a furnace door in preserving the metal from burning and warping.

This door is adapted not only for land, but for locomotive and marine steam boilers and furnaces for kilns and house-heating purposes. It is the invention of W. A. Hennessy, and is made by the R. F. Hawkins Iron Works, Springfield, Mass.

The AMERICAN MACHINIST says: "The fact that Graff, Bennett & Co., of Pittsburgh, iron manufacturers, have been able to pay off an indebtedness of a million dollars for which they got an extension from their creditors four years ago is used as an argument that there is still some profit in the iron business." Graff, Bennett & Co. were able to pay off their indebtedness by selling large blocks of valuable real estate, and by parting with their interest in one or more iron enterprises in which they had been partners. They still retain the ownership of two large rolling mills and several blast furnaces.—*The Bulletin.*

We fail to see that our contemporary has added to or taken away from the conclusion in the above. The fact, as it interprets it, is that from something directly or indirectly connected with the iron business, Graff, Bennett & Co. have been enabled, by the accumulation of values, to pay off the indebtedness named in four years and still retain property which we assume to be worth more than one million dollars. We may say, in passing, that we are glad that this is so; we might further add that the conduct of the firm in the matter appears to be such as will receive universal commendation.

The latest theory regarding the origin of natural gas is, not that the gas is a product of petroleum deposits, but just the reverse, namely, that the petroleum supply is a product or residuum of the natural gas.

Sea Water for Street Sprinkling.

The Commissioners of Bournemouth have sanctioned a scheme for laying salt water over the town for the purposes of filling the water carts and flushing the sewers. The undertaking has been designed by their surveyor, Mr. G. R. Andrews, and includes two 9 horse-power gas engines, 11,183 yards of 6 inch distributing main, 11,360 yards of 4 inch main, 57 water standards, and 57 hydrants. On Thursday, May 12, the matter was the subject of an inquiry by the Local Government Board, and much interesting information as to the use of salt water was given in evidence. Mr. Andrews stated that the water would not cost more than 5d. per 1,000 gallons, and that in thirty years, when the reduction of the debt was complete, the cost would be less than 3d. Mr. H. P Bulnois, of Portsmouth, stated that salt water was most successful in laying dust, particularly on gravel roads, as it made a kind of skin which bound the surface together. In ordinary weather one sprinkling of salt water every other day was as effectual as two sprinklings of fresh water every day. For flushing purposes he had found the salt water gave rise to no more smell than fresh water. Mr. J. W. Cockerell, of Great Yarmouth, said that he had used salt water for the roads for seventeen years, and had laid down an installation costing £4,500 for pumping and distributing it. He found that the salt water "gummed" the surfaces of the roads, and in the sewers produced no inconvenience. In 1885 he used 10,000,000 gallons of water, of which 2,000,000 were for flushing purposes. Dr. Arthur Angell, county analyst, deposed that sea water has no prejudicial action, as regards health.—*Engineering.*

From sunrise till midnight there were fourteen distinct fires one day recently in Chicago.

Utilizing a Vacuum.

A Chicago inventor, Dr. De Baussett, has at last devised a means whereby he expects to "run by vacuum," as far as this can ever be done. The doctor proposes to build an enormous air-ship of metal, and get the necessary buoyancy by producing a vacuum, more or less perfect in its interior. Then he will propel his ship by means of propellers acting against the air. By the use of necessary machinery he will be able to increase the vacuum inside his ship, when desirable, and he can of course let in air when necessary. He thinks he will be able to build the ship so strong as to resist the collapsing pressure of the external air, and yet so light that it will float. Exactly what the doctor proposes is to make a voyage to the North Pole, not by vacuum, we are glad to know, but by the use of good honest propelling power.

One of the prominent features of the Master Car Builders' meeting at Minneapolis was the great number of exhibitions made by manufacturers. In this respect it resembled a liberally-patronized fair.

Petroleum Refuse as Fuel in a Locomotive.

On the Pennsylvania Railroad a series of experiments with petroleum refuse as a fuel are now in progress. This fuel is not petroleum itself, but the refuse of the distillation, and in this country this refuse amounts to 25 to 30 per cent. The locomotive with which the experiments are made is an ordinary eight-wheeled passenger locomotive having cylinders 18 inches in diameter and 24 inches stroke; the driving wheels are 62 inches in diameter. The apparatus for burning the residuum is attached without making any change in the locomotive or tender. In conducting the experiments, the engine is made to haul regular passenger trains up heavy grades between Pittsburgh and Altoona.

Although the results of the experiments have not yet been tabulated, we can safely state the following facts as the results of these experiments: It is perfectly practible to use petroleum refuse as a fuel in a locomotive. No mechanical difficulties are in the way. Plenty of steam can be made so as to maintain a high rate of speed of train—say 35 miles an hour and over. One pound of this refuse will evaporate as much water as $1\frac{3}{4}$ pounds of coal.

The principle of the apparatus used for burning this refuse is substantially the same as that of the one invented by Mr. Urquhart, described and illustrated in full in *Engineering* June 11 and 25, 1886, as in use on a Russian railroad.

In that an injector is placed below the bottom of furnace, outside but near the rear end of the fire-box. This injector receives steam from the boiler and the refuse of petroleum stored in a tank which is placed on the tender; both the steam and oil are injected into the furnace of the locomotive, where they are caused to ignite. The heat of the flame is very intense, so much so that the sight hole through which the flame is observed has to be covered with colored glass to protect the eyes of the fireman. The direct impact of the flame is detrimental to the plates of the fire-box, and also unfavorable to the perfect combustion of the gases. Consequently the combustion is made to take place in an area inclosed by brickwork, which becomes very hot. When the engine is standing still or running down a grade with steam shut off, the flame must be extinguished and the fire-box shut up by closing the dampers. Even under these conditions the steam will continue to rise from the gradual emission of heat stored in the brickwork of the fire-box. When the stoppage is ended, or the grade passed, the flame is lighted again by first turning on the steam and gradually admitting the oil, which catches fire from the hot bricks without any explosion. The dampers can then be opened and the full supply of oil turned on, according to the load and character of the road. When the boiler is cold it is customary to first raise the steam by a temporary attachment to a stationary boiler or switching engine, and then create a draft by turning on the blower in the smoke stack. A handful of burning waste or shavings is then placed in the combustion chamber and the steam and oil turned on in succession. The oil immediately ignites, and when this is done the full supply can be given, the combustion being regulated until there is only a thin transparent smoke to be seen at the chimney top. Skill and care in the regulations are the two most important points in the use of this fuel on a railroad in order to avoid smoke, and at the same time not to admit an excessive quantity of cold air.

In Russia this invention of Mr. Urquhart is now considered a commercial success, and is used to a considerable extent, to the exclusion of coal. But when we take into consideration the high price of coal in that country, and also remember that in Russia the petroleum refuse amounts to 70 per cent., instead of 20 per cent., as in this country, we can discern a reason for the success of this fuel in Russia. In regard to the use of this fuel in a country where coal is comparatively cheap, and the percentage of petroleum refuse comparatively small, we believe, for obvious reasons, that its use on railroads cannot be extensive. Yet, when we consider the nuisance of the smoke and dust caused by the use of coal, it may be a very profitable venture to use the petroleum refuse as a fuel for a limited number of passenger locomotives, as the prevention of smoke and dust, as claimed for this fuel, will increase the comfort of the passengers to an inestimable degree.

The Pennsylvania Railroad is noted for its perseverance in increasing the comfort of its patrons, and has again shown itself as far ahead as any other company, by the use of its new vestibule cars which make up the New York and Chicago limited express. The design of these cars is such, that when they are coupled, a vestibule is formed between the cars allowing passengers to pass from one car to another in perfect safety, and at the same time protecting them from all inconvenience and hurtful effects of draft, wind and storms in passing from one car to another. It may also be noted that one of these cars is divided into four compartments, namely, the baggage compartment, a small library, smoking room and barber's shop. Another car is divided into two compartments, namely, the kitchen and dining room. The remaining cars are sleeping cars. For elegance of design and high degree of comfort we believe these cars are not excelled by any car in this country or in Europe; if now they should be able to attach to this train a locomotive which creates no smoke, throws out no cinders, and is odorless, they will have accomplished an achievement of which they may well be proud, and which will greatly increase the comfort of their patrons and be appreciated by the traveling public.

AMERICAN MACHINIST

PUBLISHED WEEKLY

BY

American Machinist Publishing Co.

HORACE B. MILLER, Pres't.
JACKSON BAILEY, Vice-Pres't.
LYCURGUS B. MOORE, Treas. and Sec'y.
96 Fulton Street, New York.

JACKSON BAILEY, Editor. HORACE B. MILLER, Business Manager.

F. F. HEMENWAY, Mechanical Engineer.

The American News Company,
Publishers' Agents, New York.
The International News Company,
11 BOUVERIE STREET, Fleet Street, LONDON, ENG., will receive subscriptions for the AMERICAN MACHINIST, at 14/7 per annum, postage paid.

DEALERS SUPPLIED BY

The Albany News Company, Albany, N. Y.
The American News Company, New York, N. Y.
The Baltimore News Company, Baltimore, Md.
The Brooklyn News Company, Brooklyn, N. Y.
The Central News Company, Philadelphia, Pa.
The Cincinnati News Company, Cincinnati, Ohio.
The Cleveland News Company, Cleveland, Ohio.
The Colorado News Company, Denver, Colorado.
The Detroit News Company, Detroit, Mich.
The International News Company, New York, N. Y.
The Minnesota News Company, St. Paul, Minn.
The Montreal News Company, Montreal, Canada.
The National News Company, New York, N. Y.
The Newark News Company, Newark, N J.
The New England News Company, Boston, Mass.
The New Orleans News Company, New Orleans, La.
The New York News Company, New York, N. Y.
The Northern News Company, Troy, N. Y.
The Omaha News Company, Omaha, Neb.
The Pittsburgh News Company, Pittsburgh, Pa.
The Rhode Island News Company, Providence, R. I.
The San Francisco News Co., San Francisco, Cal.
The South West News Company, Kansas City, Mo.
The St. Louis News Company, St. Louis, Mo.
The Toronto News Co., Toronto, Ontario, Canada.
The Toronto News Co., Clifton, Ontario, Canada.
The Union News Company, New York, N. Y.
The Washington News Company, Washington, D. C.
The Western News Company, Chicago, Ill.
The Williamsburgh News Co., Brooklyn, E. D., N. Y.

SUBSCRIPTION.

$2.50 a year in advance, postage prepaid in the United States and Canada.
$3.50 a year to Foreign Countries, postage prepaid.

ADVERTISING.

Transient, 35c. per line, each insertion.
"Business Specials," 50c. a line.

EDITORIAL ANNOUNCEMENTS.

☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from parctical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once.*

NEW YORK, JULY 9, 1887.

CONTENTS.

	PAGE
The Hoppes Feed Water Purifier	1
Ethics in a Machine Shop	1, 2
Modern Locomotive Construction. By J. G. A. Meyer. Forty-second Paper	2, 3
Utilizing a Vacuum	3
Application of Mariotte's Law	4
Tests of the Comparative Value of Different Kinds of Belting	4
Testing Water Wheels	5
Melting Iron With Natural Gas in Place of Coke	5
Open Side Iron Planer	5
Safety of Stay Bolts	5
Water Better than Bullets	5
Power Required to Drive Machine Tools	5
Letters from Practical Men—Steam Fire Engine Boilers. By Wm. H. Bradt—Graphite in Steam Cylinders. By B. W. Benton—Drilling Chilled Castings. By C. D. Rathbone—Making Blue Prints Without a Glass Frame. By E. J. Armstrong—New Odontograph. By H. Flatvad	6
Twenty-first Annual Convention of the Master Car Builders' Association	6, 7
Fluorspar in the Iron Furnace	7
The Eureka Hot-Air Furnace Door	7
Petroleum Refuse as Fuel in a Locomotive	7
Sea Water for Street Sprinkling	7
No Boom Wanted	8
Delaying the Issue of Patents	8
Bad Logic	8
Questions and Answers	8, 9
Manufactures	9
Machinists' Supplies and Iron	10

No Boom Wanted.

There is some evidence that things in a manufacturing way are working along towards that undesirable condition called a boom. We hope that sound common sense will dictate stopping short of reaching this undesirable end. It is demonstrated about once every ten years that a boom is bad for the country. A few may get richer for it, but the majority in the end get poorer. Something in an educational way ought to have been gained by past experience in such matters. Just now one of the most noticeable indications of the spirit of unrest is manifested in fictitious land values, in building up towns and cities on paper, and in efforts to push manufacture in some localities faster than there are legitimate openings. New towns and cities are putting forth extraordinary efforts to induce the starting of new manufacture, and the removal to their localities of that which is established elsewhere, and the infection is spreading to those parts of the country that are older, as such things are spoken of. Pushing along manufacture—showing up the advantage of special locations and offering inducements—is an excellent thing within reasonable limits; it is when these limits are exceeded that mischief results. Nothing is more desirable for a city than to have iron works, cotton, woolen and other fac tories in profitable operation. They represent increased valuation many times beyond their cost. But, on the contrary, nothing is worse for a city than to have scattered over it—the more the worse—closed and deserted mills, factories built ten years sooner than they ought to have been. In this latter case the value of property is correspondingly depreciated: there is no single thing that will operate so successfully in making all enterprise shun a city as closed factories, mills, and workshops. While manufacture should be helped along as fast as it can be legitimately increased, the petition to be delivered from all booms should be fervid. Steady, legitimate increase in manufacture—not spasmodic, over-zealous effort—is what helps make a country, or a locality, rich and prosperous. "Booming" things along helps no one but a few speculators, at the expense of a good many victims.

Delaying the Issue of Patents.

An enterprising patent attorney, in his published circular, points out that it often requires five, ten and even twelve years to get a really valuable patented invention even introduced to the public, and made profitable to the owner, during all which time the lifetime of the patent is being spent. The circular therefore, in substance, advises the inventor, that his interest "will be best served by allowing his application to remain in the Patent Office, as a pending application, until he has got his invention introduced and proved its value, and until the infringer begins his travels."

This advice, as expressed in the following extract, we cut out and enclosed to the Commissioner of Patents at Washington, asking if its recommendations were in accord with the practice of the Patent Office:

After the application is once filed in the Patent Office, the inventor can keep his pending application alive for an indefinite period by amending it once in every two years. (Sect. 4,894, Rev. Stats. of United States.)

So, if an inventor wishes to keep his pending application alive in the Patent Office, and deems it to be for his interest not to take out his patent at present, in such a case especial care should be taken to so amend the application that the patent will not be prematurely "allowed."

After the application for a patent is once "allowed," the inventor must pay the final government fee of twenty dollars within six months after that date, else he forfeits his pending patent application and the first government fee of fifteen dollars already paid. (Sects. 4,885 and 4,897, Rev. Stats. of United States.)

The inventor, however, may afterwards file an entirely new application for a patent, providing he is not barred by the two years of public use or sale before spoken of.

It is therefore evident that the inventor, by proper management, can keep alive his right to a patent for an indefinite period, and this notwithstanding the invention may have been on sale or in public use for over two years before the grant of the patent.

To this inquiry we received the following reply, under date June 4, 1887:

The Commissioner instructs me to acknowledge the receipt of your letter of the 23d ultimo, and in reply to say that section 4,894 of the Revised Statutes requires all applications for patents to be completed and prepared for examination within two years after the filing of the petition; and it also requires the applicant to prosecute the same within two years after any action therein by the Office. The rules require, however, that an applicant shall, within the two years, take such action upon his application as its condition requires. Applications have been known to be pending in this office for ten or more years before patents have been granted thereon, in view of the provisions of this section. It may then be said that the statements contained in the printed slip enclosed by you are substantially true. It might be well to say, in this connection, that no inventor has the exclusive right to the use of his invention in advance of obtaining a patent therefor.

Very respectfully,
SCHUYLER DURYEE,
Chief Clerk.

From the above letter it would appear, either that the patent attorney, in advising, not as a matter of necessity, but as a matter of business policy, what appears to be a studied evasion of the provision of the patent law, which limits the life of patents to seventeen years, is advising the inventor to take a dangerous course, in view of the concluding sentence of the Commissioner's letter, or that the law is loosely drawn or administered. While the inventor should have every facility afforded him for perfecting his invention, any attempt to virtually extend the life of the patent beyond the term prescribed by law, on mere pretexts, is one that may have a very doubtful result. If others than the patentee should meantime enter upon the manufacture of the article covered by the delayed application, while so delayed (and the Commissioner says "no inventor has the exclusive right to the use of his invention in advance of obtaining a patent therefor"), would not the fact of such manufacture be likely to embarrass the patentee when his patent is finally taken out? And suppose such manufacturers should offer proof that the patentee managed to keep his application pending for years in the Patent Office, by means of amendment pretexts, not for the purpose of perfecting the invention, but for the purpose of "beating the law"?

We do not share the views of those who believe that the United States patent laws tend to foster unjust monopolies, or that they are radically defective and should be greatly changed. But, like most other things in this world, they may doubtless be improved in some of their provisions and phraseology.

Bad Logic.

The hardest master that the laborer can have is rum. In a Rhode Island town recently, of $700 marked bills paid out to the employes of a factory on Saturday night $400 had been deposited in the local banks by saloon keepers forty-eight hours later.—*Railway Register.*

We are firm believers in the efficacy of good honest temperance argument, but the motto of the politician that a lie well stuck to is as good as the truth will not work in temperance matters. The above quotation, with some variation as to figures, has been going the rounds of the press for the past ten or fifteen years. If it means anything it means that four-sevenths of the wages of laborers is spent for strong drink. Assuming this, it is not, and never was true. It is not true generally, and is not true of the particular instance specified. Following out the same line of logic, if the single ten dollar bill that the laborer received for wages Saturday night was found with the baker Monday morning, it would be conclusive evidence that he spent all his money for bread!

Such argument is used by people of the best intentions in the world, but in its use they show themselves to be far from wise. They are poor advocates of a good cause. They forget that those to whom they address their argument have intelligence enough to see that it is not true, and this is a fatal mistake.

Let temperance advocates talk to and write for workingmen as if they supposed them to have common intelligence, and they will do them good. There is plenty of room to do them good in respect to temperance, but not a whit more than there is to do good to doctors, lawyers, bankers, and others of a different estate. Hard as it may be for some very good people to believe, there is in this country, amongst those who work with their hands, a greater proportion of total abstinence men than there is amongst the balance of the inhabitants.

We received invitations, accompanied by a letter from the chairman of the reception committee, to be present at a farewell reception given by the Civil Engineers' Club, of Cleveland, Ohio, to their former president, J. F. Holloway, June 16, 1887. We regret that we were unable to be present. The reception was specially tendered at this time on account of Mr. Holloway's early removal from Cleveland to New York, where he has lately connected himself with the firm of Henry R. Worthington.

New York has gained many citizens at Cleveland's expense, but few whom Cleveland could so ill afford to lose.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(289) R. L. D., Atlanta, Ga., asks: Will you tell me the rule for finding the length of a link, and also for finding the length of lifting shaft arms? *A.*—For finding the length of a link, see AMERICAN MACHINIST February 26, 1887, page 3. For finding the length of lifting shaft arms, see AMERICAN MACHINIST May 31st, 1884, page 6. And for a practical application of these rules, see AMERICAN MACHINIST December 4th, 1886, page 2.

(290) W. J. R., Lowell, Mass., writes: The enclosed sketches represent a cap-head for a ten-inch cylinder. As we were testing the cylinder the question arose as to which way the head could be screwed on the tightest—with the spanner, as in Fig. 1, or with the bar, as in Fig. 2? For my part, I cannot see any difference. *A.*—You are right; there can be no difference, because the distance from the center of cylinder head to end of the wrench is the same in both cases.

(291) Saw Mill, Towanda, Pa., writes: I have an engine 12"x18", making 190 revolutions per minute. Steam pressure, 80 pounds, and cutting off at ¼ stroke. We do not obtain the power we think we should obtain. What can we do with it to obtain more power? The party who owns the engine thinks of putting on an eccentric with larger throw and a new valve. Will this do any good? If not, what will? *A.*—You should have stated the amount of power developed by the engine at the present time; without these data we cannot advise you what to do. Judging from the last clause of your question, it is evident that the owner of the engine believes the steam ports are not opened sufficiently, and consequently wants an eccentric of larger throw, so as to obtain a longer travel and open the steam ports wider. He must also have some doubt of the correct construction of the slide valve; in short, the owner believes the valve motion to be incorrectly designed. If he is right, a change in the eccentric and valve may have the desired effect. If the valve motion is correctly designed, a change in the eccentric and valve will make matters worse. If the engine is correctly designed, you can only obtain an increase of power by increasing the steam pressure.

(292) G. C. G., Philadelphia, Pa., writes: We have a steel gib to plane, the dimensions of which are 3 feet long, 1½ inches wide, and ¼ of an inch thick. We have no chuck to do it with nor time to make one. Can you tell us how to do this job without springing it, and make it perfectly true? Also state the speed at which the planer should be run to do this job. *A.*—First level the gib without straining it out of its natural form on the bed of the planer, keeping it about ½ of an inch above the bed by putting a few wooden wedges along the ends and sides of the gib; when in this

position clamp it down very gently, or simply place weights upon it to hold it in position. Then place putty all around the gib, and pour in plaster of Paris so as to fill the space between the gib and bed of planer, which will form a good hard surface for gib to lie upon; then carefully clamp the gib to planer; here good mechanical judgment must be used, otherwise the gib will be strained into an unnatural position, and when done will spring out of true. The speed of planer should be from 12 to 16 feet per minute.

(293) J. A. S., Minneapolis, Minn., writes: In one class of our engines the steam ports are the same size, the outside and inside lap are the same, the lead the same at both sides, the eccentrics have the same throw, and the rocker arms are the same length on both sides. Now, setting the valves when the engine is cold, hook her up, run over the travel and set her as square as I can, we find that in running the engine on the road for trial we most always have to change the position of the eccentrics a little one way or another to make the exhaust sound the same. Why is it that on some engines we cannot get all the four exhausts to beat alike? They will sound alike, one just as heavy as the other, but two exhausts will be a little quicker than the rest. Say, when the crosshead is on the back end on the left side, front end on the right side, and back end on the right side, these three exhausts beat the same and equal distances apart, but between the right back and left front the exhaust is a little quicker or closer together, and by changing the eccentrics we do not seem to better it any. Now can you explain what the cause of this is? This trouble seems to be only in a certain class of engines. I will say also that when the engine is hooked up in the back motion, she seems to be perfect; it is only when she is hooked up in the forward motion, say eight inches. *A.*—In the first place, it will be better for you to set the valve gear when the engine is hot, which will to a great extent do away with the re-setting of the eccentrics on the road. As to the inequailty of the exhaust, we believe, from the description you have given us, that the trouble will be found in the position of the saddle pin on one of the links. You may easily satisfy yourself on this point by using a temporary loose saddle pin in place of the one now in use, and thus determine its true position. The trouble may also be caused by an incorrect position of the lifting shaft, or the trouble may be caused by both the lifting shaft and the saddle, although we believe that it is the latter that should be reset.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Gear Wheels. See Geo. B. Grant's adv., p. 16.

Link-Belting.

Send for catalogue of Link-Belting.

Over 50,000,000 feet of Link Belt in use.

Link-Belt Machinery Co., Chicago and N. Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Edw. Sears, Wood Engraver, 189 William st, N. Y.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

AirCompressors, Rock Drills. J. Clayton, 43 Dey st., NY

Exhaust Tumbl'g Bbls. Henderson B's., Waterb'y, Ct.

For Improved Cooper Stoves, send to Variety Machine Co., Warsaw, N. Y.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 120 Liberty st., N. Y.

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y

Solid Nickel-Seated "Pop" Safety Valves. Consolidated Safety Valve Co., 111 Liberty st., Y. N.

Robbs' Patent Composition for case-hardening. Send for circular. F. W. Tasney, Paterson, N. J.

Davis Key-Seating Machines, kept in stock, by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Injectors, Ejectors, Oil Cups, Sight Feed Lubricators, etc. Arthur Appleton, 45 Cortlandt st., N. Y.

20", 25", 28" B.G. and S. F. upright drills for immediate delivery. Currier & Snyder, Worcester, Mass.

Ice and Refrigerating Machines. 124 built, and all successful. David Boyle, 521 Monroe St., Chicago, Ill.

Drawing Materials, all kinds. Get catalogue. Mention this paper. G. S. Woolman, 116 Fulton st., N. Y.

The Improved Tabor Steam Engine Indicator, made and sold by The Ashcroft Mfg. Co., 111 Liberty st., N. Y.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large; prices low. Frasse & Co., 92 Park row, N. Y.

Wanted—To meet a party prepared to build and market simplest, cheapest Wire Nail Machine offered. Address Box 36, AM. MACHINIST.

Curtis Pressure Regulators, Curtis Return Trap, Curtis Damper Regulator. See June 11, p. 12. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

Machinists' supplies, brass goods, m'f'rs' supplies, polishing materials, all kinds wire, metals, etc.; in any quantity. Jordan & Gottfried, 208 Canal st., N. Y.

For Best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N. Y. Send for des'n.

Patents, American and Foreign, promptly procured and sold on best terms by Jas. H. Lancaster, patent attorney, 187 Broadway, N. Y., and London.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

The Holly Manufacturing Company, of Lockport, N. Y., will send, on application, their pamphlet illustrating pumping machinery and reports of duty trials.

Press for sale. Quick-acting; hole in bed, 8x5 punches to center of 13-inch sheet; 2¼-inch shaft; also four-spindle Drill. B. W. Payne & Sons, Elmira, New York.

Reed's Engineer's Hand-Book to the Local Board Examinations. Eleventh edition revised and enlarged, with 260 diagrams and 36 large plates. 8vo., cloth, $4.50, post-paid. Catalogue of books free. E. & F. N. Spon, 35 Murray st., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price, $2 post-paid. Published by John Wiley & Sons, 15 Astor Place, New York.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers, the full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton st., New York.

MANUFACTURES

Water works will be built at Albany, Ga.

Steelton, Pa., is looking for new water works.

James Adair will build a brick factory at 363 Ninth avenue, New York.

J. E A. Gibbs is interested in building a foundry and machine shop at Raphine, Va.

At Little Rock, Ark., Louis Koers will build a two-story addition to his carriage factory.

The East Ferry Street Iron Works (Alexander Traud), Newark, N. J., are building a foundry 40x50 feet.

The Southern Pacific Railroad Company are concentrating several of their machine shops at Houston, Tex.

The Cleveland City Forge and Iron Company, of Cleveland, are fitting up a new machine shop, 100x45 feet in size.

The Kanawha and Ohio Railroad Company have received permit to erect a frame machine shop in Charleston, W. Va.

S. K. Weymouth, Gardiner, Me., proposes to form a stock company for manufacturing a combination lock of his invention.

The citizens of Warsaw, Ill., are looking for propositions for supplying them with water through a well system.

The Louisville and Nashville Railroad have under consideration the removal of their shops from Nashville and Mobile to Birmingham, Ala.

The Bradley & Currier Company, Hudson, corner Spring street, New York city, are looking up lots on which to erect a large sash, blind and door factory.

D. H. Brown, 601 Bedford avenue, Brooklyn, N. Y., is building a three-story brick moulding shop, 35x21 feet, on Wallabout street, near Wythe avenue.

The Cary Pump Manufacturing Company will remove from Fairhaven, Mass., to Warren, R. I. The latter town has voted to remit their taxes for five years.

The machine shop formerly known as the Tozer & Dial shop, at Columbus, Ga., will be put in operation by parties who have recently purchased it.

Walter Rodgers, 848 De Kalb avenue, Brooklyn, N. Y., is building a one-story frame brass and iron foundry, 25x50 feet, on Bedford avenue, near North Thirteenth street.

The buildings of the Sequachee Hoe and Tool Company, at South Pittsburg, Tenn., are being pushed by the contractors, and the factory will be in operation July 1st.

The Fort Worth Water Power and Manufacturing Company has been chartered at Fort Worth, Tex., with capital stock of $250,000. B. C. Evans is one of the incorporators.

The Westinghouse Machine Company, Pittsburgh, Mass., have their new foundry nearly completed. When done they expect to be able to turn out 100 engines per month.

T. W. Merryman, 305 South Sharp street, George Gebelin, 731 North Castle street, and the Clotworthy Chemical Company, all of Baltimore, Md., will put in new engines and boilers.

The stockholders of the Clifton Cotton Mills on the Pacolet River, Spartanburg, S. C., have agreed to build a second mill about half a mile below Clifton, to be run by water-power.

The Brenham (Tex.) *Weekly Banner* is urgent to have the Brazos Valley Railroad completed to that town, and says the water supply there is ample for the largest manufacturing industries.

Amzi Hill, architect, has plans for a four-story brick factory, 50x90 feet, on Columbia street, between Nelson and Laqueer streets, Brooklyn, N. Y., for V. Savarese & Bros., to cost $20,000.

Work is being steadily pushed on the new shoe shop at Athol, Mass., for F. E. Breed, of Lynn. It will be heated both by steam and water, and is expected to be ready for occupancy about October 1st.

The New York Manufacturing Company—capital stock, $50,000—has been incorporated to manufacture agricultural machinery at Birmingham, Ala., by F. W. Watkins, J. H. Smith and G. W. Wells.

There are over 700 subscribers to the proposed Dallas (Tex.) Cotton and Woolen Mills, who have subscribed from $100 to $200 each. It is thought the mills will be running within a year, and will employ 500 hands.

The Albany Steam Trap Company, Albany, N. Y., have just taken an order for a large filter for use in the Governor's new mansion. We presume the Executive will confine its use entirely to filtering water.

The matte, or crude black copper, from the mines of Montana, which has been hitherto shipped to Wales for reduction to black copper, is now to be sent to Duluth, Minn., where extensive works are to be built.

The Vulcan Iron Company, Richmond, Va., has been incorporated, to enlarge the Vulcan Iron Works and add a rolling mill, with T. Seddon Bruce as president, and Philip A. Bruce, secretary and treasurer. The capital stock is to be not less than $100,000.

John A. Fitten, Reuben Jones, T. M. Clarke, R. C. Clark, Louis Gholstin, A. H. Cox and others, of Atlanta, Ga., have chartered the American Railway Equipment Company; capital stock, $1,000,000. Its object is to buy, sell and manufacture railroad cars, etc.

The Pusey & Jones Company, of Wilmington, Del., have just taken what is said to be the largest single order for paper-making machinery ever given in the world. It consists of four complete mills and other machinery for mills at Palmer's Falls, N. Y.

A new coke company is about to ask for a charter, under the name of the Hostetter Coal and Coke Company. They propose to build 1,000 ovens on the Southwest branch of the Pennsylvania Railroad. The first ovens will be built near Mt. Pleasant, Pa.

Part of the works of the U. S. Electric Light Company, Newark, N. J., were destroyed by fire on June 17, including the engine-rooms, which contained three large engines. Considerable other machinery was destroyed. Rebuilding will begin at once.

We inadvertently gave the name of the new tool company at Springfield, Ohio, as the "Springfield Tool Manufacturing Company;" it should have been given as the Springfield Machine Tool Company. We understand that the new company has good prospects of business.

Sulzer & Vogt, Louisville, Ky., write us: "An item in your paper under the head of 'Manufacturers,' in which you report us as having burned out, is not correct. The fire was confined entirely to our machine shop, and we were shut down about four days. Are running again as usual."

The Silver & Deming Manufacturing Company, one of the largest manufacturing firms of Salem, Ohio, are building a new moulding room, which will enable them to employ one-third more moulders than at present. They will also employ additional mechanics in other departments.

The Dixon Crucible Company, of Jersey City, have lately brought out a line of colored crayons, or all-lead pencils, without the customary wooden casings. They are adapted for drawing, checking invoices, marking papers, and a great variety of purposes for which fine lines are not required.

The *Daily News-Herald*, of Jacksonville, Fla., says Whitney & Co., of Chicago, Ill., representing Chicago capitalists, who bought 25,000 acres of land in Levy County through Williams & Swann, of Fernandina, have begun operations to establish a number of large saw-mills, with facilities for water shipment.

The *Paper Mill* says it has just come to light that there is a pulp mill in New York which is running on stable refuse. The mill is located at Thirty-ninth street and the North River, and the product is sold as straw pulp. From ten to fifteen tons a day are made. There is a special apparatus for bleaching the refuse.

A. J. Stevens, general master mechanic of the Central Pacific Railroad, is building 37 new locomotives at the company's shops at Sacramento. Several of them are heavy engines of the El Gobernador type, with Stevens valve motion, which is reported to be giving entire satisfaction mechanically, and as a means of saving steam.

A new enterprise has been inaugurated at Newark, Ohio, under the name of the Newark Wire Cloth Company. They are manufacturers of brass and copper wire cloth and brass and copper wire. The officers of the company are Chas. Kibler, jr., president; John S. Bradley, vice-president; L. F. Tenney, treasurer; and R. F. Minckler, secretary.

John Wiley & Sons, 15 Astor place, New York, have made a selection from their latest catalogue of books, and have published it with a stiff cover, which makes it much more easily preserved and convenient for reference. It is a book of 175 pages, containing a list of standard works on engineering, workshop practice, etc., etc. Full titles, descriptions and press notices are given.

Young E. Allison, secretary of the Board of Trade Committee on Industrial and Commercial Improvement, Louisville, Ky., writes us that any practical cotton mill superintendent in the East who understands the making of honest rough sheetings, who has some capital to invest and will come to Louisville, can readily, if the right sort of man otherwise, secure additional capital and solid backing.

Post & Co., of Cincinnati, Ohio, write us that a company has just been formed there with $650,000 capital, and which has purchased all patents of value relating to and covering electrical and steam appliances for headlights. Their firm has taken the exclusive manufacture of same, and intend to push it vigorously. The lights have been in successful use for nearly two years on some prominent railroads.

Detrick & Harvey, Baltimore, Md., have had recent orders for the open side iron planers as follows: Robt. Wetherill & Co., Chester, Pa., a 36"x10 ft.; Weimer Machine Works Company, Lebanon, Pa., a 36"x20 ft.; Henry Disston & Sons, Tacony, Pa., a 30"x8 ft.; J. Regester & Sons, a 30"x8 ft., second order; Carnegie, Phipps & Co., Munhall, Pa., 30"x12 ft.; Taws & Hartman, Philadelphia., Pa., a 25"x6 ft.

Some weeks ago we noted that the J. Morton Poole Company, of Wilmington, Del., were to build a new foundry. It is being erected from plans prepared by L. C. Jewett, of Yonkers, N. Y. They have had a platform with a turn-table built in it for their cupola stage hoist, made by Otis Bros. & Co., and just shipped to them, they furnishing the hydraulic ram to operate it. They expect to take off a heat by August 1st.

Owing to their large and increasing trade in the West, the Sandford Fork and Tool Manufacturing Company, Cortland, N. Y., have concluded to remove the most of their plant to Terre Haute, Ind., where they will increase their manufactures, both in amount and variety. Their Western location will enable them to fill their orders more promptly than heretofore in this section, while the Eastern and export orders will be billed from Cortland.

The Rollstone Machine Company, Fitchburg, Mass., are running overtime to keep up with orders. In addition to their line of wood-working machinery, they are making machinery for the Smith refrigerating and ice-making system. This system is gaining many friends among some of the prominent brewers, meat packers, etc., over this country, and inquiries relating to its merit and success are now coming from foreign countries.

The insurance companies have adjusted the loss caused by the explosion at the Hitchcock Manufacturing Company's works at Cortland, N. Y., and the work of clearing away the debris is begun preparatory to rebuilding. The company have made arrangements with the Elmira, Cortland and Northern Railroad Company for the use of one of their engines to run their works until a new boiler can be put in. The engine will be placed on a side track near the works.

The main building, for which ground has just been broken, for their new works at Plainfield, N. J., by the Pond Machine Tool Company, will cover 96x500 feet. The land required by them is 200x3,200 feet, lying parallel with the Central Railroad of New Jersey. In addition to the main building, they will erect a foundry 85x250 feet; also a boiler and engine house, pattern and storage houses, coal sheds, etc. The land is on a grade with the railroad, and switches will be built running into the main building, foundry and coal sheds, with elevated trestle-work facilities for dumping coal.

The National Pipe Bending Company, of New Haven, Conn., have received an order from the Southern Cotton Oil Company for eight of their national feed-water heaters with exhaust noise-deadeners and oil-separators. This combination of noise-deadener and oil-separator becomes valuable in electric light stations and other places where rapid-running engines are used. The order referred to comprises two 500 horse-power heaters and six 400 horse-power heaters, and they are to be delivered in eight of the large Southern cities by August 15th. The company is busy making coils of iron, brass and copper pipe, for which they are especially fitted up.

The Southern Cotton Oil Company have awarded their boiler contracts to the Abendroth & Root Manufacturing Company, and their engines to the Westinghouse Machine Company. This contract comprises eight 150 horse-power, two 75 horse-power, twelve 60 horse-power, twenty-two 45 horse-power, eight 25 horse-power and eight 15 horse-power engines, aggregating 3,380 horse-power, and is doubtless the largest and most important single order for engines which has been given in this country. These engines are to go in eight different mills throughout the Southern States. Shafting is to be largely dispensed with, and the mill operated by independent power in each department.

E. Hulbert, of Atlanta, Ga., writes as follows to the *Manufacturers' Record:* "One of the most pressing wants of Atlanta in a manufacturing line is that of modern first-class machine works. Extensive works with modern machinery and appliances for doing all kinds of work promptly and cheaply, in the hands of experts, and backed with ample working capital, would have a wide and profitable field of operations. With the large number of new manufacturing enterprises that are being established in this and adjoining States, the demand for new machinery of all kinds is very great, and rapidly increasing. The demand for repairs is also very great and pressing, it frequently occurring that machinery requiring repairs has to be shipped long distances to the original maker, incurring not only a heavy expense in the shipment, but a still heavier one in the loss of time."

Machinists' Supplies and Iron.

NEW YORK, June 23, 1887.

Generally speaking, manufacturing and supply business continues absolutely without change. In most branches of the machine business shops are fairly well off for orders, but there are but few instances where any great rush is apparent. The condition in this respect is an entirely healthy one.

Iron—The market in American pig is certainly not lively, nor can it fairly be described as dull. There seems to be entire absence of any intention on the part of consumers to contract ahead at present prices, and furnacemen are not inclined to grant any concessions. The result is that sales just cover the demands of current consumption, and furnacemen limit the output to meet this demand without permitting stock to accumulate. Both consumer and producer seem to be entirely at sea as to the probabilities of future prices. There is but little stock of standard brands of No. 1 iron offered; No. 2 is offered more freely. Transactions in inferior brands have been more numerous than in strictly first-class. We quote for standard brands No. 1 X Foundry, $21 to $21.50; No. 2 X, $19.50 to $20; Grey Forge, $17.50 to $18.50.

Scotch Pig—There is no change in the market for Scotch brands. Prices are still firm in Glasgow, but it is doubtful if the American market will be affected to any extent. Sales have been made of Coltness, $22 to $22.50: Gartsherrie, $21.50 to $22; Summerlee, $21.50 to $22: Eglinton, $20.50 to $21; Dalmellington, $20.50 to $21.

Antimony—There is nothing more than the regular jobbing demand. Hallett's brand sells for 8c. Cookson's, 9c.

Copper—The market is quiet, without sign of change. Lake has sold at 10c., but bids are mostly 9.90c.

Lead—There is manifest intention to hold prices firm at 4.70c.; this has prevented more than nominal transactions. Buyers are not inclined to offer this figure.

Spelter—Sales have been unusually small. Refined continues to sell at 5¾c. to 6c.

Tin—The firmness in the London market has had the effect to stimulate business here. This, coupled with the fact that there is a scarcity of spot, has made a slight advance in prices possible. Jobbing lots of Banca have sold at 23½c., but are hardly obtainable at that figure. Straits and Malacca have sold at 23¼c.

✻WANTED✻

"Situation and Help" Advertisements only inserted under this head. Rate, 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Wanted—Competent foreman to take charge of old-established iron foundry. Apply 115 Liberty st., New York.

Wanted—Position by young married man familiar with general machine shop work, drafting and designing of machinery. Derf, AM. MACHINIST.

Wanted—A young man graduate from college, 6 years as machinist, age 25 years, wants position as draftsman. L. Möller, 140 Lake st., Cleveland, O.

Assistant Draftsman—Situation wanted by a young man, graduate from technical school; five years as machinist; references. Address C. K., 360 Van Brunt st., Brooklyn, N. Y.

Situation wanted as ass't superintendent or ass't manager by a young man—responsible party, experienced mechanic and designer; good references. Address N. H. L., care AM. MACHINIST.

Wanted—"A Yankee contractor" wanted in a shop engaged in manufacturing small engine lathes; must be able to get work out quick and cheap. Address "Lathe," care AM. MACHINIST.

Wanted—Competent draftsman, experienced on general machine shop, blast furnace and rolling mill work; give references and state salary expected. Address Gaysport Foundry, Hollidaysburg, Pa.

Wanted—A man to travel for sale of injectors, oilers, lubricators and other boiler appliances; must be posted in injector trade, and be a good salesman and have good references. Address J., care AM. MACHINIST.

Wanted—Small dynamo engines; send specifications giving size and space, lowest prices on quick-running engines, 450 to 500 revolutions, 2 to 3 H. P.; no dead centers; governor acted upon by live steam to couple direct to shaft of dynamo; complete, with oilers, etc. Post & Co., Cincinnati, O.

A practical draftsman, engineer and machinist is open for engagement; thoroughly familiar with and capable of designing Corliss engines, either condensing or compound, of all sizes and with any style of valve gear in use; experienced with uses of indicator, and able to make duty tests; acquainted with prices; will engage with parties contemplating building Corliss engines, or with established concerns as head draftsman, superintendent or engineer. Address Y. J., AM. MACH.

✢ MISCELLANEOUS WANTS. ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Crescent steel tube scrapers are unquestionably the best. Crescent Mfg. Co., Cleveland, Ohio.

Crescent boiler tube cutter, for setting new and removing old tubes. Crescent Mfg. Co., Cleveland, O.

Light mach'y of all kinds built at short notice Edmund Mills, 8 Dey st., Jersey City Heights, N. J.

Stationary boat engines, boilers, best, cheapest, 1 to 10 H. P. Washburn Engine Co., Medina, Ohio.

Wanted—Good second-hand iron planer, medium size. Address Greenleaf Turntable Mfg. Co., Indianapolis, Ind.

Special tools and machines for mfg. designed and built to order; mechanical and Patent Office drawings. I. A. Weston & Co., Syracuse, N. Y.

A. C. Christensen, mechanical and hydr. engineer, late chief draftsman for Henry R. Worthington. Designs and working drawings; also patent drawings. 26 Church st., R. 13 and 14, New York.

Manufacturing Business for Sale—I have a long-established commercial business which requires my entire time; I also own controlling interest in and have been managing the business of a corporation manufacturing a useful patented machine, demand for which is growing more general each year. In past five years 150 machines have been sold at prices ranging from $125 to $1,000; all are giving best of satisfaction. I want to dispose of the manufacturing business to some person or firm having the financial and mechanical ability required to extend the business, which can be made a large one. Will stand thorough investigation. Address Box 40, care AM. MACHINIST.

BRADLEY'S HEATING FORGES.

ESTABLISHED 1832.

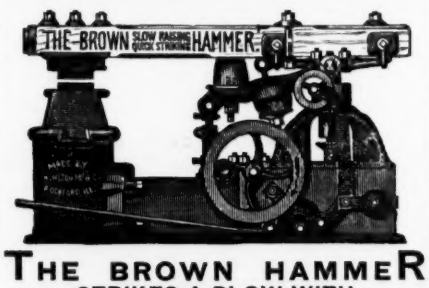
For Hard Coal or Coke. Indispensable in all shops to keep **Bradley's Cushioned Hammers** and men fully employed and reduces cost of production.

BRADLEY'S UPRIGHT CUSHIONED HELVE HAMMER

Established 1832.

Combines all the best elements essential in a first-class Hammer. Has more good points, does more and better work and costs less for repairs than any other **Hammer** in the **World.**

BRADLEY & CO. Syracuse, N.Y.



THE BROWN HAMMER
STRIKES A BLOW WITH
Double the Velocity That it Raises the Hammer.
A NEW MOVEMENT! SEND FOR DESCRIPTION.
KNOWLTON MFG. CO., KING ST., ROCKFORD, ILL.

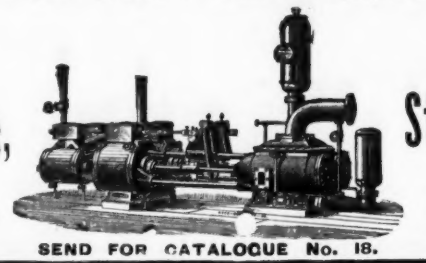
T. SHRIVER & Co's
IRON FOUNDRY,
333
East 56th St.,
NEW YORK.
Contracts Solicited for Machinery Castings in regular supply.

ONE-HALF TIME and LABOR saved by using this solid, strong, durable, firm-hold, quick working Lever (Not Screw) Vise. Has improved Taper-Pipe and other attachments. Sold by the trade. Send for circular
TOWER & LYON,
95 Chambers Street, New York.
Successors to MELVIN STEPHENS.

GEO. F. BLAKE MANF'G. CO.
BUILDERS OF EVERY VARIETY OF

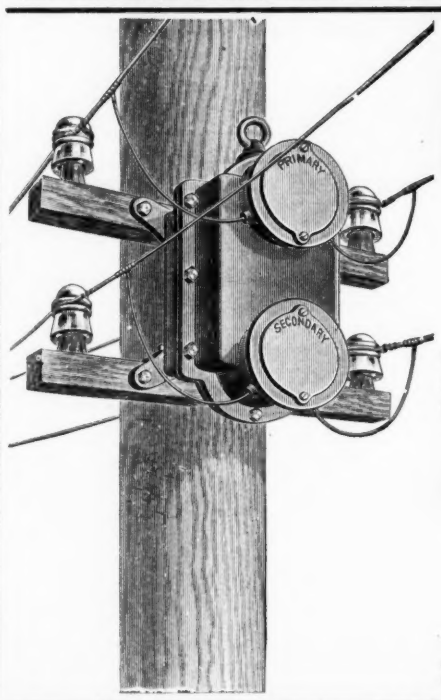
95 & 97 LIBERTY ST., NEW YORK. 111 FEDERAL ST., BOSTON.
WATER WORKS PUMPING ENGINES A SPECIALTY

THE DEANE STEAM PUMP CO., Holyoke, Mass.
BUILD AND
Water Works, Steam Pumping
ENGINES MACHINERY.



SEND FOR CATALOGUE No. 18.

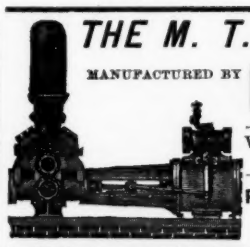
IF YOU WANT A
SHAPER, PLANER, DRILL, LATHE OR SPECIAL MACHINERY,
WRITE TO
THE HENDEY MACHINE CO.,
SEND FOR A CATALOGUE. TORRINGTON, CONN.



—THE—
Alternating SYSTEM.

Incandescent Electric Lighting from Central Stations, made Universal, Economical and Profitable, irrespective of distance.

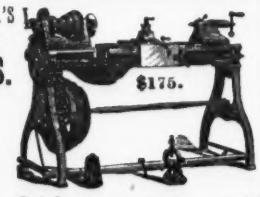
—THE—
WESTINGHOUSE ELECTRIC CO.
PITTSBURGH, PA.
EASTERN OFFICE,
17 CORTLANDT ST., NEW YORK.



THE M. T. DAVIDSON IMPROVED STEAM PUMP,
MANUFACTURED BY DAVIDSON STEAM PUMP COMPANY.
WARRANTED THE BEST PUMP MADE FOR ALL SITUATIONS.
PRINCIPAL OFFICE, No. 77 LIBERTY STREET, N. Y.
NEW ENGLAND OFFICE, 51 OLIVER STREET, BOSTON, MASS.

STEAM HEATING FOR BUILDINGS,
Or, Hints to Steam Fitters. Being a description of Steam Heating Apparatus for Warming and Ventilating Private Houses and Large Buildings, with Remarks on Steam, Water and Air in their Relations to Heating. To which are added useful miscellaneous tables. By Wm. J. Baldwin. Eighth edition, revised and enlarged. With many illustrative plates. 12mo, cloth, $2.50.
"Mr. Baldwin has supplied a want long felt for a practical work on Heating and Heating Apparatus."—*Sanitary Engineer.*
JOHN WILEY & SONS, 15 Astor Pl., N. Y.
Publishers of Scientific and Industrial Works.
*** *Will be mailed and prepaid on the receipt of the price. Catalogues and Circulars free by mail*

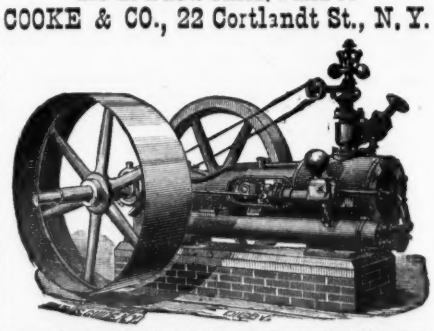
SEBASTIAN, MAY & CO.'S
Improved Screw Cutting
FOOT or POWER LATHES.



Catalogue of Lathes, Drill Presses and Machinists Tools and Supplies mailed on application. *Lathes on Trial.*
167 W. Second St., CINCINNATI, O

The BEST in the World.
SUSTAINED BY THE U. S. COURTS.
The DUPLEX, UNION and ALERT
INJECTORS.
Simple in construction. Easily taken apart. No springs to get out of order. Always ready. Always delivers water hot to boiler. Thousands in use and demand increasing. Send for Catalogue, to
JAS. JENKS & CO., Detroit Mich., or to
A. APPLETON, 45 Cortlandt Street, N. Y.

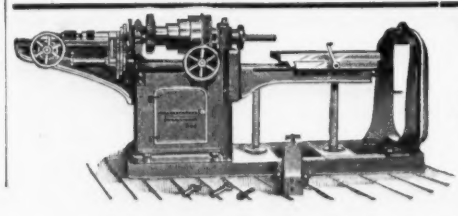
IF YOU WANT A STRONG, ECONOMICAL
ENGINE
EITHER HORIZONTAL OR VERTICAL,
FOR STEADY EVERY DAY AND ALL-NIGHT SERVICE AND AT A LOW PRICE, WRITE TO
COOKE & CO., 22 Cortlandt St., N. Y.



Twelve hundred Engines in use. Please mention this paper.

E P. B. SOUTHWORTH,
94 Exchange street, Rochester, New York.
Indicating Engineer and Mechanical Draftsman.
Correspondence solicited.

GUILD & GARRISON,
BROOKLYN, N. Y.
STEAM PUMPS,
VACUUM PUMPS,
AIR COMPRESSORS.
SEND FOR CATALOGUE.



BETTS MACHINE COMP'Y,
WILMINGTON, DEL.,
MAKERS OF
Metal-working Machine Tools
OF SUPERIOR QUALITY,
FOR USE IN
MACHINE AND RAILWAY SHOPS.

NICHOLSON FILE CO. —SOLE MFRS. OF

FILE CARD.

Files and Rasps

FILE BRUSH.

Having the Increment Cut.

The illustrations herewith presented, exhibit more convenient and durable forms of **File Cleaners** than are usually found, the majority of those in use being rudely devised and troublesome, and we believe for this reason, those of our manufacture will find a ready sale. Machinists and others who have not already given them a trial, will find it to their advantage to order the **File Card** and **File Brush** at once.

Manufactory and Office,

PROVIDENCE, R. I., U. S. A.

THE HANCOCK INSPIRATOR.

THE STANDARD

BOILER FEEDER FOR ALL CLASSES OF BOILERS.

OVER 85,000 IN USE.

Send for Circulars and Price Lists.

THE HANCOCK INSPIRATOR CO.

OFFICE, 33 INDIA WHARF, BOSTON, MASS.

THE NEW "GRESHAM" PATENT

AUTOMATIC RE-STARTING INJECTOR

"Invaluable for use in Traction, Farm, Portable Marine and Stationary Boilers of all kinds. No handles required. Water supply very difficult to break. Capability of re-starting automatically, immediately after interruption to feed from any cause."

SEND FOR CATALOGUE. **RELIABLE AND CHEAP.**

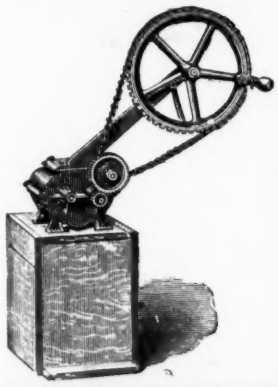
Sole Manufacturers in the United States and Canada.

NATHAN MANUFACTURING CO.

92 & 94 LIBERTY ST., - - - NEW YORK.

ROOTS' NEW ACME HAND-BLOWER.

For Blacksmiths, etc. Slow Speed, Positive Blast. Is Durable Compact and Cheap, also Portable Forges, Tuyere Irons and Foundry Blowers.



P. H & F. M. ROOTS, Mfrs.
CONNERSVILLE, IND.
S. S. TOWNSEND, Gen. Agt., 22 CORTLANDT ST., NEW YORK.
COOKE & CO., Selling Agts.,
Please Mention This Paper.

PRICE REDUCED.

H. W. JOHNS'

ASBESTOS ROOFING

FIRE AND WATER-PROOF BUILDING FELT, FIRE-PROOF PAINTS, STEAM PACKINGS, BOILER COVERINGS, ETC.

Samples and descriptive Price List free by mail.

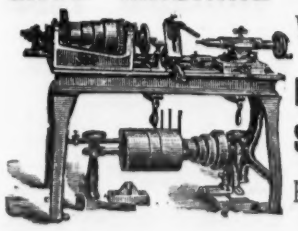
H. W. JOHNS M'F'G CO., 87 MAIDEN LANE, N. Y.

ONE WOOD CHUCK-

le to himself, were he in need of such a tool, to know that "THE SWEETLAND CHUCK," guaranteed to be the best lathe chuck made, could be bought at the price we are offering it; our INDEPENDENT CHUCKS we are also selling low. Write for discounts. Established 1849.

THE HOGGSON & PETTIS MFG. CO.,
NEW HAVEN, CONN.

GAGE MACHINE WORKS,



Waterford, N. Y

Manuf'r's of

Fox, Turret AND Speed Lathes AND Brass Finishers' TOOLS.

EDWARDS' PRACTICAL STEAM ENGINEER'S GUIDE.

RECENTLY PUBLISHED.

The Practical Steam Engineer's Guide in the Design, Construction and Management of American Stationary, Portable and Steam Fire Engines, Steam Pumps, Boilers, Injectors, Governors, Indicators, Pistons and Rings, Safety Valves and Steam Gauges. For the use of Engineers, Firemen and Steam Users. By Emory Edwards, Author of "A Catechism of the Marine Steam Engine," etc. Illustrated by 119 engravings. 3d edition, revised and corrected. In one volume. 12mo, 420 pages, $2.50, *free of postage to any address in the world.*

Abstract of Contents.

Introduction. Chapter I. Standard American Stationary Engines. II. Standard American Stationary Boilers. III. Standard American Portable Steam Engines and Boilers. IV. Standard American Agricultural Engines. V. Standard American Steam Fire Engines. VI. Standard American Steam Pumps. VII. Injector. VIII. Steam Engine Governors. IX. The Steam Engine Indicator. X. Slide Valves. XI. The Piston and its Rings. XII. Safety Valves, their Antecedents, Invention, History and Calculation. XIII. Steam Gauges. XIV. Practical Notes on the Management of Steam Engines and Boilers. Index.

BY THE SAME AUTHOR.

Modern American Locomotive Engines, their Design, Construction and Management. Illustrated. 12mo. 383 pages, - - - - - - - - - - $2.00

Modern American Marine Engines, Boilers, and Screw Propellers. Their Design and Construction. Showing the Present Practice of the most Eminent Engineers and Marine Engine Builders in the United States. By Emory Edwards. Illustrated by 30 large and elaborate plates. 4to. - - - - - - - - - - $5.00

A Catechism of the Marine Steam Engine. For the use of Engineers, Firemen and Mechanics. A Practical Work for Practical Men. Illustrated by 63 engravings, including examples of the most modern engines. Third edition, thoroughly revised, with much new matter. 12mo. 414 pages. - - - - - - - - - - $2.00

☞ *The above or any of our Books sent by mail free of Postage, at the publication price, to any address in the world.*

☞ *An illustrated circular, 6 pages, 4to, showing the full table of contents of each one of Emory Edwards' works, sent free and free of postage to any one in any part of the world who will furnish us with his address.*

☞ *Our new Catalogue of Practical and Scientific Books, 96 pages, 8vo, as well as a Catalogue of Books on Steam and the Steam Engine, Mechanics, Machinery, and Dynamical Engineering, and a catalogue of Books on Civil Engineering, Bridge Building, Strength of Materials, Railroad Construction, and other Catalogues, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.*

HENRY CAREY BAIRD & CO.,
INDUSTRIAL PUBLISHERS, BOOKSELLERS & IMPORTERS,
810 Walnut St., Philadelphia, Pa., U. S. A.

L. S. STARRETT,
Manufacturer of
FINE TOOLS
ATHOL, MASS.
SEND FOR FULL LIST.

REDUCED PRICES OF LeCount's Light Steel Dog

No.	INCH.	PRICE.	No.	INCH.	PRICE.
1	3/16	$ .35	8	2	$1.10
2	1/4	.35	Small Set of 8-5.50		
3	5/16	.50	9	2 1/2	1.40
4	1	.60	10	3	1.50
5	1 1/4	.75	11	3 1/2	1.70
6	1 1/2	.85	12	4	1.90
7	1 3/4	1.00	Full Set of 12-12.00		

C. W. LECOUNT,

SOUTH NORWALK, CONN.

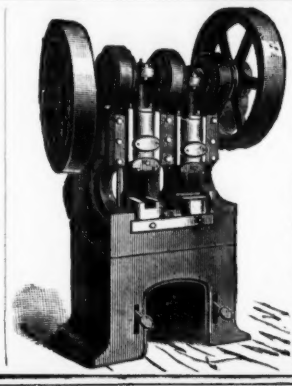
PARK MFG. CO.

MANUFACTURER OF

34 Beach Street, Boston, Mass.

The Park Injector,

EJECTORS AND JET APPARATUS.



BEAUDRY'S DUPLEX Power Press

COMBINING PRESS, SHEARS AND PUNCH.

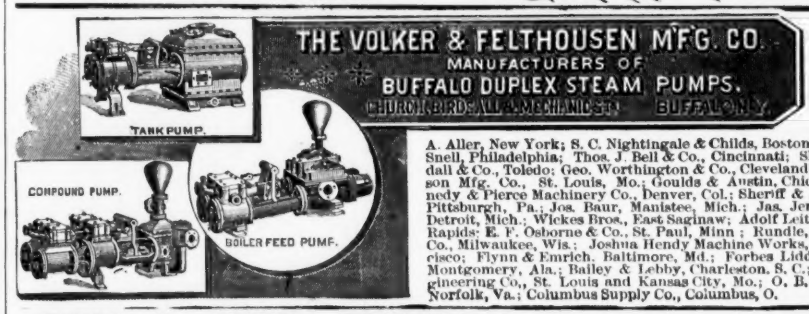
BEAUDRY & CO.

(Formerly of Beaudry's Upright Power Hammer.)

Sole Manufacturers.

Also manufacturers of HARD COAL HEATING FORGES.

Room 4, MASON B'DG, 70 KILBY ST., Boston, Mass.



THE VOLKER & FELTHOUSEN M'F'G. CO.
MANUFACTURERS OF
BUFFALO DUPLEX STEAM PUMPS.
CHURCH BIRD'S ALL A. MECHANIC ST. BUFFALO N.Y.

For Sale at Factory Prices by

A. Aller, New York; S. C. Nightingale & Childs, Boston; Henry I. Snell, Philadelphia; Thos. J. Bell & Co., Cincinnati; Shaw, Kendall & Co., Toledo; Geo. Worthington & Co., Cleveland; N. O. Nelson Mfg. Co., St. Louis, Mo.; Goulds & Austin, Chicago; Kennedy & Pierce Machinery Co., Denver, Col.; Sheriff & Ashworth, Pittsburgh, Pa.; Jos. Baur, Manistee, Mich.; Jas. Jenks & Co., Detroit, Mich.; Wickes Bros., East Saginaw; Adolf Leitelt, Grand Rapids; E. F. Osborne & Co., St. Paul, Minn; Rundle, Spence & Co., Milwaukee, Wis.; Joshua Hendy Machine Works, San Francisco; Flynn & Emrich, Baltimore, Md.; Forbes Liddell & Co., Montgomery, Ala.; Bailey & Lebby, Charleston, S. C.; Pond Engineering Co., St. Louis and Kansas City, Mo.; O. B. Goodwin, Norfolk, Va.; Columbus Supply Co., Columbus, O.

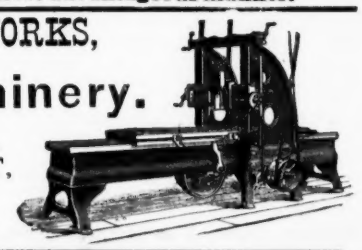
THOS. D. WEST FOUNDRY CO., Cleveland, Ohio,

Manufacturers of Light and Heavy Iron Castings in Green, Dry Sand or Loam, also Machinery and Architectural Wood or Metal Patterns for Outside use. Patterns constructed durably and to mould in the most advantageous manner.

FITCHBURG MACHINE WORKS,

Manufacturers of

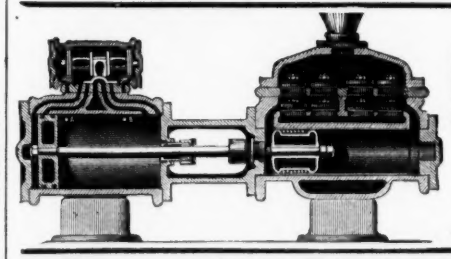
Metal-Working Machinery.



OFFICE AND WORKS:

NOS. 13 to 21 MAIN STREET,
FITCHBURG, MASS.

SEND FOR CATALOGUE E.



HALL DUPLEX PISTON PUMP

Simple,
Durable,
Efficient.

HALL STEAM PUMP CO.,
91 LIBERTY ST., NEW YORK.

WHY THIS IS PUT HERE!

For the reason that if you are interested in raising water or other liquids by steam power, we wish to call your attention to the

NEW PULSOMETER,

THE CHEAPEST AND BEST STEAM PUMP IN THE MARKET. PRICES LOWER THAN ANY OTHER.

More Efficient, Simple, Durable, and more Economical, both as to running expenses and repairs, than any other Steam Pump.

Call or write for our new 96 page Illustrated Descriptive Book containing Full Particulars, Reduced Net Prices, and hundreds of A-1 Testimonials. Mailed Free.

PULSOMETER STEAM PUMP CO., 83 JOHN STREET, N. Y.

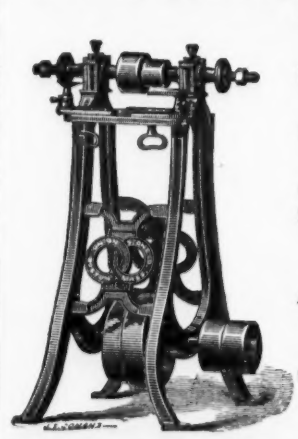
FRICTION

CLUTCH PULLEYS AND CUT-OFF COUPLINGS.

JAS. HUNTER & SON,
North Adams, Mass.

UNION STONE COMPANY,

38 & 40 Hawley St., Boston, Mass.



EMERY-WHEEL GRINDING MACHINERY, EMERY WHEELS AND TOOLS.

MACHINERY FOR POLISHING WHEELS, POLISHING BELTS, AND POLISHING BUFFS, AND ALL SUPPLIES PERTAINING THERETO.

ELECTRO-PLATERS' SUPPLIES.

B. GRINDING MACHINE.
1" Shaft. Takes Wheels to 14" diameter. Countershaft with hangers or in machine. Is specially adapted to light work in machine shop, tool grinding, etc.

ECONOMICAL STEAM BOILERS
A SPECIALTY.

SEND FOR PRICES. Pond Engineering Co. ST. LOUIS, MO.

"Twenty Years with the Indicator."—2 vols., $3.00. By THOS. PRAY, JR., C. & C. E. and C. & M. E. Six thousand sold. J. Wiley's Sons, 15 Astor Place, N. Y., or Thos. Pray, Jr., P. O. Box 2728, Boston, Mass.

WORTHINGTON —HIGH DUTY— Pumping Engine

—FOR—

WATER WORKS

OVER 100,000,000 DUTY

—GUARANTEED—

SEND FOR RECENTLY ISSUED PAMPHLET

HENRY R. WORTHINGTON
NEW YORK CITY.

SAFE ECONOMICAL DURABLE BOILERS
HARRISON SAFETY BOILER WORKS. PHILADELPHIA, PA.
MERITS PROVEN 20 YEARS RECORD

"STEAM" A VALUABLE BOOK for EVERY STEAM USER AND ENGINEER
PUBLISHED FOR FREE DISTRIBUTION, BY
THE BABCOCK & WILCOX CO.
Manufacturers of
WATER-TUBE BOILERS,
107 Hope St., GLASGOW. *30 Cortlandt St., NEW YORK.*

BRIDGEPORT BOILER WORKS. BRIDGEPORT CONN.
SEE THE IMPROVEMENTS IN STEAM BOILERS, BOILER FRONTS, BOILER FURNACES, AND FEED WATER HEATERS MADE AT THESE WORKS BEFORE BUYING STEAM PLANT. SEND FOR HISTORIES OF STEAM BOILERS AND FEED WATER HEATERS (FREE) ON MENTIONING THIS PAPER.
W.M. LOWE.

The Armstrong Mfg. Co.
BRIDGEPORT, CONN.
Water, GAS AND STEAM Fitters' Tools.
STOCKS AND DIES FOR PIPE, BOLTS AND BRASS PIPE WRENCHES, PIPE VISES, ETC.
— SEND FOR CATALOGUE. —

FOR SUBSTANTIAL, WELL MADE, LOW PRICED
20 INCH DRILLS,
With latest improvements, Lever or Wheel feed, address
Sibley & Ware,
SOUTH BEND - - INDIANA.

WALKER'S TOOL HOLDER.
For holding drills and reamers for lathe work. Prevents breaking or slipping. Can also be used for drilling and reaming holes by hand, and for reaming holes under drill presses, etc. Made with double handle, when required.
WALKER MFG. CO., CLEVELAND, OHIO.

J. WENDELL COLE, M. E.
Manager of Pennsylvania Southern Lake regions and the Northwest for
DETROIT EMERY WHEEL CO.
Address, Box 84, Columbus, O., or P. O. Box 152 Chicago.
Hart's Corundum-Emery Wheels.

WORCESTER MACHINE SCREW CO.
WORCESTER, MASS.
Machine Screws for all Purposes.
All Goods Shipped Direct from Factory.

Hydrostatic Machinery,
PRESSES, PUMPS, PUNCHES,
ACCUMULATORS,
Jacks, Valves,
FITTINGS,
Vault Elevators, Etc., Etc.
WATSON & STILLMAN,
204-210 E. 43d Street, N. Y.

EAGLE ANVIL WORKS,
Trenton, N. J.
The Fisher Double Screw Leg Vise.—Warranted stronger grip than any other Vise. Always parallel and cannot be broken.
Send for Circulars.
The Eagle Anvil.—Best Cast Steel Face & Steel Horn. Better than any English anvil. Fully warranted and lower price.

NEW HAVEN MANUF'G CO.,
New Haven, Conn.
Lathes,
Planers,
Shapers,
Slotters,
Etc.

Buffalo Cupola & Forge Blowers.
Warranted superior to any other make.
All sizes and styles of every class of work.
BUFFALO FORGE CO.
Buffalo, N. Y.
Send for Catalogue and Prices.

Lubricate Your Engine CYLINDERS
perfectly, gain power and save oil by using our Patent Automatic Sight Feed Lubricators, showing oil as it enters, drop by drop.
THE SEIBERT Cylinder Oil Cup Co.
BOSTON, MASS.
H. A. ROGERS,
Agent for New York,
19 John Street,
NEW YORK.

THOS. H. DALLETT & CO.
13th & Buttonwood Sts., PHILA. PA
Manufacturers of
PATENT Portable Drilling Machines,
VERTICAL DRILLS,
Radial Drills, Multiple Drills,
HAND DRILLS.
SEND for ILLUSTRATED CATALOGUE.

JENKINS STANDARD PACKING TRADE-MARK
The Original Unvulcanized Packing
CALLED THE STANDARD—A[illegible] packing by which al[illegible]rs are compared.
Accept no packing as JENKINS PACKING unless stamped with our "Trade Mark."
JENKINS BROS. 71 JOHN STREET, N. Y. 105 MILK STREET, BOSTON. 13 SOUTH FOURTH ST., PHILA. 54 DEARBORN STREET, CHICAGO.

WESTCOTT CHUCK CO., ONEIDA, N. Y.
MANUFACTURERS OF
LATHE and DRILL CHUCKS
SEND FOR CATALOGUE.

GEARED CHUCKS.
Jaws Reversible.

Diameter.	Capacity.
5 inch.	5 inch.
7⅛ "	7½ "
10⅛ "	10⅛ "
13 "	13⅛ "
15¼ "	17 "
18 "	19¾ "
21 "	25½ "
24 "	28 "

William Barker & Co.
Manufacturers of
IRON AND BRASS —WORKING— MACHINERY
140 & 142 E. Sixth Street, N'r Culvert, Cincinnati, O.
Send for circulars and prices.

MACHINISTS' SCALES,
Patent End Graduation.
We invite comparison for accuracy with all others.
Every Scale Guaranteed. Send for List.
COFFIN & LEIGHTON, SYRACUSE, N. Y.

A Complete Cutting-off Machine, $4.00
Larger ones which cut to 2 in. $8.00
SENT ON TRIAL.
Drill Presses, Tap Drill Gauges.
STERLING ELLIOTT, Newton, Mass.

"CUSHMAN" CHUCKS
Are guaranteed to be right in all respects. Ask to see them at your dealers, or write direct to the factory. Respectfully,
THE CUSHMAN CHUCK CO.,
HARTFORD, CONN.

HOOPER'S 70% GRATE BAR.
Will not Warp.
Will not burn off at the ends.
Will give absolutely 70% air space.
Will give uniform combustion of fuel.
Send for Circular and Price List to
ALEXANDER TRAUD,
EAST FERRY STREET IRON WORKS,
NEWARK, N. J.

ESTABLISHED 1851.
The Horton Lathe Chuck.
THE E. HORTON & SON CO.
Canal St., Windsor Locks, Conn., U. S. A.

Almond Drill Chuck
Sold at all Machinists' Supply Stores.
T. R. ALMOND,
83 & 85 Washington St., Brooklyn, N. Y.

DISCOUNT TO CLUBS. WRITE FOR FULL LIST.
HARDENED STEEL SQUARES and other Fine Tools,
Manufactured by
STANDARD TOOL CO.
ATHOL, MASS.

STANDARD PUNCHES FOR IRON & STEEL PLATES.
I. P. RICHARDS STANDARD DIES PROVIDENCE R. I.

Established in 1874.
CLEVELAND TWIST DRILL CO.
24 and 26 West Street, Cleveland, O.
101 Chambers Street, New York.
85 Queen Victoria St., London, Eng.

ONE OF THE FINEST MANUFACTURING PROPERTIES IN THE COUNTRY FOR SALE OR TO RENT.
Buildings built in the most substantial manner of brick and in perfect order, and will last a lifetime without any outlay for repairs. Suitable for any kind of manufacturing where strength, durability and light is required. Buildings now filled with twelve sets of first-class woolen machinery running on fine woolens, in perfect order. This property will be sold or leased with or without the machinery. Now is the time for any one looking for a first-class piece of property to obtain same. It needs only to be seen to be appreciated.
Address P. O. Box 1102, Providence, R. I.

Katzenstein's Self-Acting Metal Packing
For Piston Rods, Valve Stems, etc., of Steam Engines, Pumps, etc., adopted and in use by leading engine builders, mills, iron works and steamship companies all over the world. Also flexible tubular metal packing for slip joints on steam pipes, and for hydraulic pressure.
L. Katzenstein & Co.,
357 WEST STREET, N. Y.

TRAUTWINE'S POCKET-BOOK.
JOHN WILEY & SONS, NEW YORK. E. & F. N. SPON, LONDON.
NEW EDITION NOW READY.

STEAM PUMPS
MADE FOR ANY SERVICE
ACME VALLEY BUCKET PLUNGER
VALLEY MACHINE CO. EASTHAMPTON, MASS.

Morse Twist Drill and Machine Comoany, New Bedford, Mass.

Manufacturerr Morse Patent Straight-Lip Increase Twist Drills.

Solid and Shell Reamers, Beach's Patent Self-Centering Chuck, Bit Stock Drills,
DRILL GRINDING MACHINES, MILLING CUTTERS AND SPECIAL TOOLS TO ORDER.

STEEL BALLS

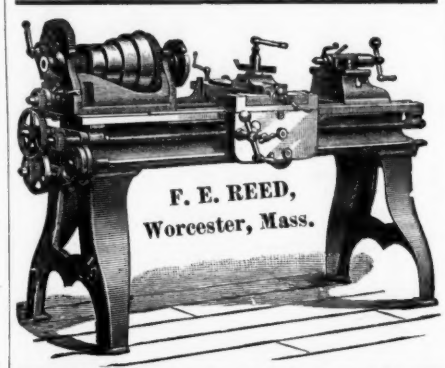
FOR ANTI-FRICTION BEARINGS,
OF BEST CAST STEEL.
HARDENED, GROUND & BURNISHED,
3-16" to 3" Diameter.
Samples and Prices on application.
SIMONDS ROLLING-MACHINE CO.
FITCHBURG, MASS.

WELDLESS STEEL TUBES

QUICK OPENING GATE VALVE
COLD DRAWN
SMOOTH INSIDE & OUT.
JOHN S. LENG, 4 Fletcher St N.Y.

BEVEL GEARS,

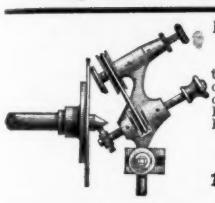
Cut Theoretically Correct.
For particulars and estimates apply to
BREHMER BROS.
Machinists,
440 N. 12th St., Philadelphia, Pa.



ENGINE Lathes, Hand Lathes, Foot Lathes, Upright Drills and Milling Machines. Agents, MANNING, MAXWELL & MOORE, 111 LIBERTY STREET, NEW YORK.

NICKEL PLATED POCKET LEVEL

2½-in. 50 cents. 3½-in. 65 cents.
By Mail on Receipt of Price.



Friction Driven Center Grinder.

A neat, simple and cheap tool to true up centers, will grind centers up quicker than they can be annealed, turned and hardened, will go on any size lathe without any adjustment.
Send for descriptive circular
ENERGY M'F'G CO.
1115 to 1123 S. 15th Street,
PHILADELPHIA, PA.

S. Ashton Hand Mfg. Co., Toughkenamon, Pa.

Hand's Twist Drill Grinding Attachment.

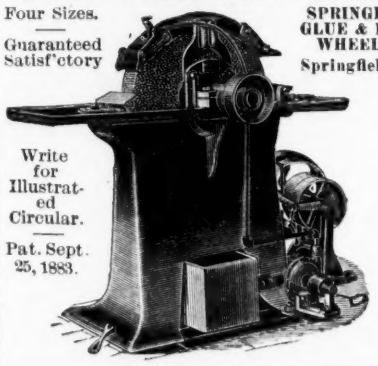
Readily attached to any grindstone, emery or cutter-grinder. Grinds right and left hand drills from 3/8" diam. down to smallest sizes
PRICE, $20.

PATENT
PLANER and SURFACE GAUGE.

An accurately graduated gauge by which planer and other tools can be quickly set at any height from the table or the work. Is also a convenient surface gauge. $3.75 each.
ARTHUR B. PHILLIPS, Manufacturer,
WHITMAN, MASS.

EMERY-WHEEL TOOL GRINDER.

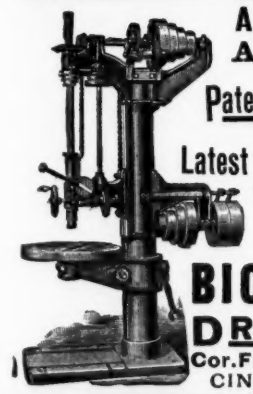
Four Sizes.
Guaranteed Satisf'ctory
Write for Illustrated Circular.
Pat. Sept. 25, 1883.



SPRINGFIELD GLUE & EMERY WHEEL CO., Springfield, Mass
Water runs on wheel and prevents heating.

UPRIGHT DRILLS

A SPECIALTY.
ALL SIZES
—WITH—
Patent Quick Return
—AND—
Latest Improvements.
For Catalogues and Prices, address,



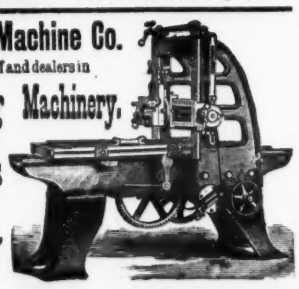
BICKFORD DRILL CO.
Cor. Front & Pike Sts.
CINCINNATI, O.

DIXON'S GRAPHITE SMEAR GREASE

For Steam or Gas Pipes, Bolts, Screws, etc.
MAKES A PERFECT JOINT THAT CAN BE OPENED WITH EASE IN THREE YEARS OR THIRTY YEARS.
Jos. Dixon Crucible Co. Jersey City, N. J.

L. W. Pond Machine Co.

Manufacturers of and dealers in
Iron Working Machinery.



IMPROVED
IRON PLANERS
A Specialty.
140 Union St., WORCESTER, MASS.

NEW YORK AGENTS.
FRASER & ARCHER,
NEW AND SECOND-HAND MACHINERY,
SHAFTING, HANGERS AND PULLEYS,
121 CHAMBERS STREET.

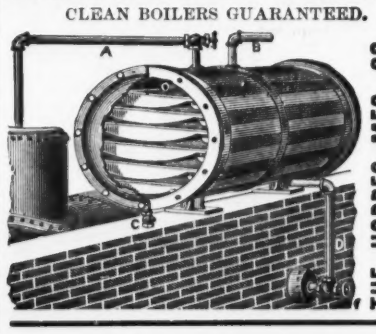
Do You Use Glue?

Improved Steam Glue Heaters

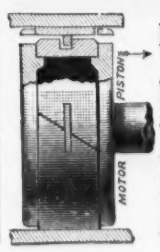
Pots without Joints, and therefore free from leakage. Furnished with plain Iron, Enameled Iron or Copper. For Pattern Makers, Cabinet Makers, Joiners, Bookbinders, in fact, all who use Glue. Please mention this paper, and send for Price List to makers. Made in nineteen different styles.

PANCOAST & MAULE,
245 South Third Street,
PHILADA, PA.
BUILD THESE

THE NEW HOPPES LIVE STEAM FEED-WATER
Heater and Lime Extractor.
CLEAN BOILERS GUARANTEED.



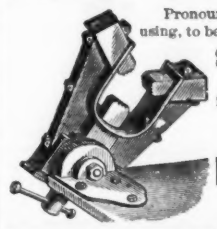
THE HOPPES MFG. CO. SPRINGFIELD, O
—Send for Catalogue D.—



Brandon's Piston Ring Packing

Perfectly balanced against undue pressure in all directions. Preserves both cylinder and rings. Allows no waste by either friction or leakage. Call and see working model, expressly made to demonstrate advantages claimed. For packing or shop rights, address
JAMES BRANDON,
390 Eleventh Ave., New York.

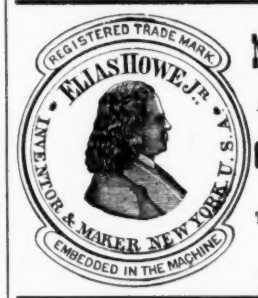
CHALLENGE OPEN TOP PIPE VISE.



Pronounced by practical men, after using, to be the best ever invented.
Sold by all Jobbers in New York Chicago, Philadelphia, St. Louis, Pittsburgh, Canada.
Send for Catalogue "A."
ELGER & ELGER,
49 BROADWAY,
NEW YORK.

—OUR— NEW CATALOGUE OF TOOLS

and Supplies sent free to any address on receipt of Ten Cents in stamps (for postage).
CHAS. A. STRELINGER & CO., Wood Ave., Detroit, Mich.



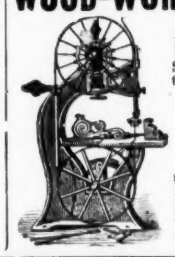
THE
New Howe Mfg. Co.
BRIDGEPORT, CONN.
Mfrs. of Sewing Machines
Light and Medium Weight
Gray Iron Castings
OF ALL DESCRIPTIONS TO ORDER; ALSO,
TOOL MAKING, JAPANNING
—AND—
PLATING.
Correspondence Solicited.

D. SAUNDERS' SONS

MANUFACTURERS OF THE ORIGINAL
TRADE I. X. L. MARK.
Pipe Cutting and Threading Machine.
BEWARE OF IMITATIONS.
None genuine without our Trade-mark and Name.
STEAM AND GAS-FITTERS' HAND TOOLS.
Pipe Cutting and Threading Machines, for Pipe Mill Use, a Specialty.
Send for Circulars. YONKERS, N. Y.

J. A. FAY & CO. CINCINNATI, OHIO, U.S.A.

BUILDERS OF IMPROVED
WOOD-WORKING MACHINERY



Embraces nearly 400 Machines for
PLANING & MATCHING
Surfacing, Moulding, Tenoning, Mortising, Boring, and Shaping, etc.
Variety and Universal
WOOD WORKERS.
Band, Scroll and Circular Saws, Resawing Machines, Spoke and Wheel Machinery, Shafting, Pulleys, etc. All of the highest standard of excellence.
W. H. DOANE, Pres't. D. L. LYON, Sec'y.

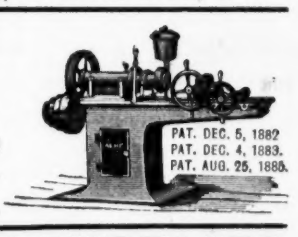
TO STEAM USERS:

MINERAL WOOL

Does not Char, Burn, Crack or Rot when applied on Cylinders, Pipes and Boilers to prevent loss by radiation. Sample and Circular free.
U. S. MINERAL WOOL CO., 22 Cortlandt St., N. Y.

ACME MACHINERY CO.,

CLEVELAND, OHIO.
Manufacturers of
"ACME"
Single & Double Automatic Boltcutters,
cutting from 3-8 in. to 6 in. diameter,
Also SEPARATE HEADS AND DIES.
Send for Catalogue and Discounts.
Agents, Manning, Maxwell & Moore, New York.



MACHINERY, TOOLS and SUPPLIES.

Complete Outfits for
MACHINISTS, BLACKSMITHS, MODEL MAKERS, JEWELERS, ETC.
Lathes, Planers, Shapers, Drill Presses, Emery Grinders, Milling Machines, Bolts, Screws, Washers, Belting, Packing, Waste, Twist Drills, Taps, Reamers, Cold Rolled Shafting, Hangers, Files.
SEND FOR ILLUSTRATED PRICE LIST OF METAL-WORKERS' TOOLS, ALSO WOOD-WORKERS'.
TALLMAN & McFADDEN, 1025 MARKET STREET, PHILADELPHIA.

SHAPING MACHINES

FOR HAND AND POWER.
6", 8" and 10" Stroke.
Adapted to All Classes of Work to their Capacity.
Circulars Furnished.
BOYNTON & PLUMMER,
WORCESTER, MASS.

W. C. YOUNG & CO., Worcester, Mass. Manufacturers of

Engine Lathes, Hand Lathes
FOOT POWER LATHES, SLIDE RESTS, Etc.

MACHINERY

For Reducing and Pointing Wire.
Especially Adapted to pointing wire rods and wire for drawing.
For Machines or information, address the manufacturer.
S. W. GOODYEAR Waterbury, Ct.

PECK'S PAT DROP PRESS.

NEW HAVEN
BEECHER & PECK, CONN

DROP FORGINGS OF IRON OR STEEL

BEECHER & PECK, NEW HAVEN CONN.

Lynde's Pat.
Pop Safety Valves,
Adapted to all Boilers.
J. E. Lonergan & Co.,
Sole Owners and Manuf'rs
PHILA., PA.

WOOD-WORKING MACHINERY

For Planing Mills, Furniture, Chair and Cabinet Factories, Cabinet Works and General Wood-Working. Send Stamp for Illustrated Catalogue to
Rollstone Machine Co.
45 WATER ST.,
FITCHBURG, MASS.

THE MASON REDUCING VALVE

GIVES SATISFACTION WHEREVER USED
OFFICE 22 CENTRAL ST. BOSTON. MASS.

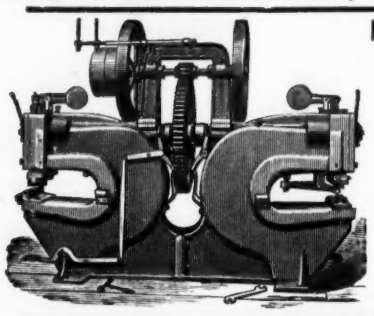
JENKINS BROS. AGENTS, New York & Chicago.

CRANES FOR SALE.

Having substituted our HIGH SPEED TRAVELING CRANE for the SWING CRANES heretofore used in our Foundry, we desire to dispose of the latter without delay and will therefore accept very low prices. These SWING CRANES were designed and constructed by ourselves for our own use. They have had good care, are in good condition, and were of the following capacities when new:

One 50 tons operated by steam engine at base of frame.
One 50 tons operated by hand.
Two 25 tons operated by hand.
Three 10 tons operated by hand.
Full particulars with prices will be given upon application.

WM. SELLERS & CO., Incorporated, Philadelphia, Pa.

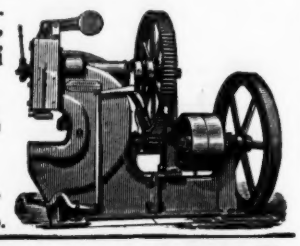


THE LONG & ALLSTATTER CO. Hamilton, OHIO.

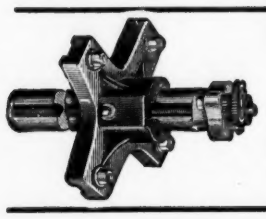
Double, Single, Angle-Bar, Gang, Horizontal, Twin, Boiler, Spacing, Gate, Multiple, Belt and Steam-Driven

Punches and Shears.

Over 300 Sizes.
ALSO,
Power Cushioned Hammer.



Send for new Catalogue.



BORING BAR FOR LATHE.

BUILT ANY SIZE REQUIRED.

Has Hardened Steel Centers, Constant Feed of Cut Gears, Steel Feed Screw and Nut, Accurately Ground, First-class Lathe Tool.

PEDRICK & AYER,
PHILADELPHIA, PA.

SENSITIVE DRILLS.

NEW STYLES.
GREAT IMPROVEMENTS.
PATENTED GANG DRILLS.
Two, Three and Four Spindles.

The spindles in these drills are driven with a single belt made endless, no lacing, and tightener pulleys for adjusting tension provided. No more trouble from slack belts, slippage, uneven motion from lacings, or time lost taking up belts.

ALWAYS READY FOR USE

and superior to any multiple spindle drill made for drilling from .004 to 3-8 inch holes.

SINGLE SPINDLE Drills improved. Over 800 in use. Send for catalogue.

DWIGHT SLATE MACHINE CO.
HARTFORD, CONN.

REMOVED

On or about June 1st

H. BICKFORD,

will remove his business to

LAKE VILLAGE, N. H.,

into new shops fitted up with new and latest improved tools, especially adapted for manufacturing Boring and Turning Mills which will be made an exclusive specialty, 4-5-6 and 8 ft. Swing.

PATENTS

R. G. Du Bois, Patent Att'y, 916 F St., Washington, D. C. Good references. Send for pamphlet.

COILS & BENDS

—OF—

IRON, BRASS and COPPER

PIPE.

ALL STYLES.

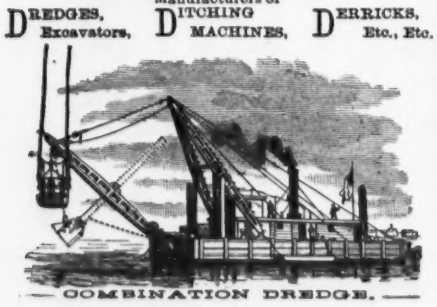
THE NATIONAL Pipe Bending Co.

NEW HAVEN, CONN.

OSGOOD DREDGE CO., - ALBANY, N. Y.
RALPH R. OSGOOD, Pres. JAMES H BLESSING, Vice-Pres.
JOHN L. HOWE, Secretary and Treasurer.

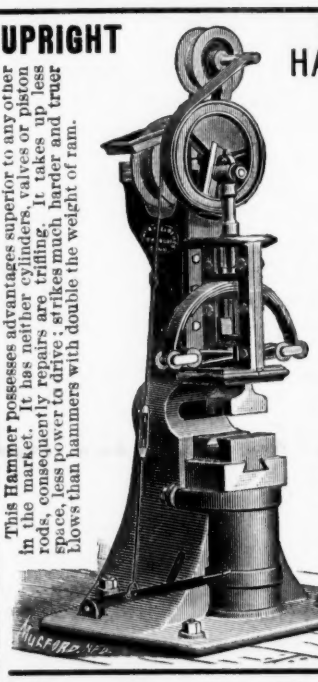
Manufacturers of

DREDGES, Excavators, DITCHING MACHINES, DERRICKS, Etc., Etc.



— COMBINATION DREDGE. —

UPRIGHT POWER HAMMER.

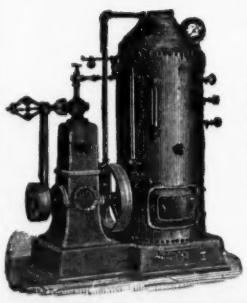


This Hammer possesses advantages superior to any other in the market. It has neither cylinders, valves or piston rods, consequently repairs are trifling. It takes up less space, less power to drive; strikes much harder and truer blows than hammers with double the weight of ram.

It can be worked to strike good alternate blows on a 3-inch and ⅜-inch bar when a 100-pound hammer is used, and can be used on die work to a far greater advantage than any other hammer known. Manufactured by the

B. A. BELDEN CO., Danbury, Conn.

The Castle Engine.



A NEW MECHANICAL MOVEMENT.

Only eight moving pieces. No packing required. Takes up its own lost motion. Noiseless and self-lubricating. Large wearing surfaces. More economical after long usage than a slide valve engine when new. High-test Steel Boilers.

Size: 1 to 10 H. Power.

Send for Circular No. 5.

Castle Engine Works, Indianapolis, Ind.

CHARLES MURRAY
ENGRAVER ON WOOD
58 ANN ST. NEW YORK.

THE NATIONAL AUTOMATIC BOLT CUTTER

"THE BEST"

PREMIUM AT EVERY EXPOSITION
CATALOGUES ON APPLICATION

BOLT HEADERS POINTERS
RIVET, SPIKE HOT & COLD UPSETTERS
CARRIAGE BOLT MACHINERY
HOT & COLD AUTOMATIC NUT & WASHER TAPPERS OF EVERY STYLE
WIRE NAIL MACHINES
THE ONLY SPECIALISTS
FURNISHING COMPLETE PLANTS
IN THE U.S.
THE NATIONAL MACHINERY CO
TIFFIN, OHIO, U.S.

BEMENT, MILES & CO.

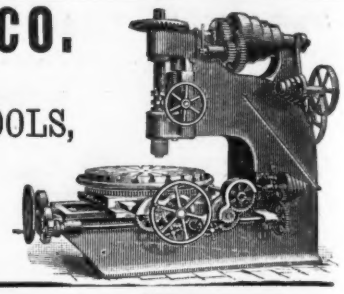
PHILADELPHIA, PA.

BUILDERS OF

METAL-WORKING MACHINE TOOLS,

FOR

RAILROAD SHOPS,
LOCOMOTIVE AND CAR BUILDERS,
MACHINE SHOPS, ROLLING MILLS,
STEAM FORGES, SHIP YARDS,
BOILER SHOPS, BRIDGE WORKS, ETC.

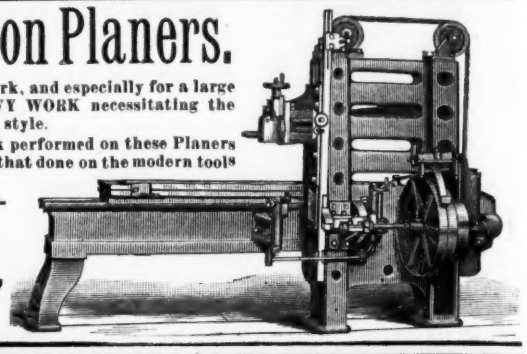


The Open Side Iron Planers.

Adapted for all classes of Machine Work, and especially for a large amount of the EXTRA WIDE and HEAVY WORK necessitating the Large and Costly Planers of the regular style.

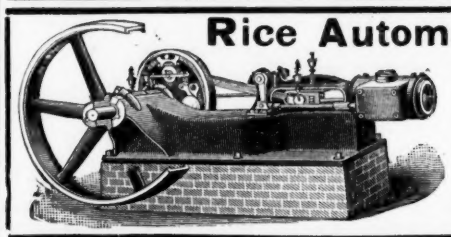
The QUALITY and QUANTITY of work performed on these Planers is GUARANTEED to be UNEXCELLED by that done on the modern tools of the very best makes.

Prices, phototypes and detailed information on application.



DETRICK & HARVEY,
BALTIMORE, MD.

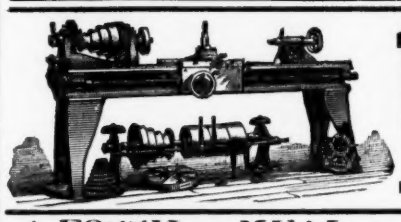
Rice Automatic Cut-off Engine



Self-Contained. Sensitive Governor.
Balanced Valve. High Speeds.
Stationary Oilers. Best Economy.

Gold Medal Cincinnati Exposition, 1884.

THE JOHN T. NOYE MFG. CO.,
BUFFALO, N. Y.

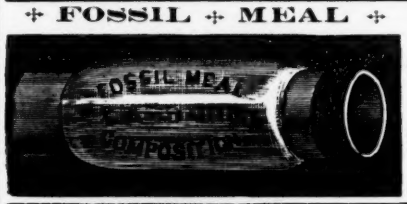


16" ENGINE LATHES

New Designs. First-class Workmanship.

THE MULLER MACHINE TOOL CO.,
Evans and Eighth Streets, - CINCINNATI, O.

✣ FOSSIL ✣ MEAL ✣



PIPE AND BOILER COVERING.

Light as Hair Felt. Absolutely Fireproof. Easily applied. Can be used over and over again. Thickness of ⅝" to ¾"; equal to other coverings at 2" to 2½".

Beware of Imitations. Sold in Bags of 110 lbs. each.

Acknowledged by leading authorities to be the best non-conducting material in the market.

FOSSIL MEAL CO., 48 Cedar St., New York.

Send for Circular. Mention this Paper.

STEEL CASTINGS

From 1-4 TO 15,000 lbs. WEIGHT.

True to Pattern, sound, solid, free from blow-holes and of unequaled strength.

Stronger and more durable than iron forgings in any position or for any service whatever.

40,000 CRANK SHAFTS and 30,000 GEAR WHEELS of this steel now running prove this.

Cross-Heads, Rockers, Piston-Heads, etc., for Locomotives.

STEEL CASTINGS of every description.

Send for Circulars and Prices to

CHESTER STEEL CASTINGS CO.,
Works, Chester, Pa. Office, 407 Library St., Philadelphia, Pa.

PATENT UNIVERSAL SCREW-CUTTING CENTER DEPTH ANGLE AND **TWIST DRILL GAUGE.**
J. WYKE & CO.,
Fine Machinists' Tools.—E. Boston, Mass.—Send for Circular

FORBES & CURTIS,

BRIDGEPORT, CT.,

Manufacturers of

The Forbes Pat. Die Stocks,

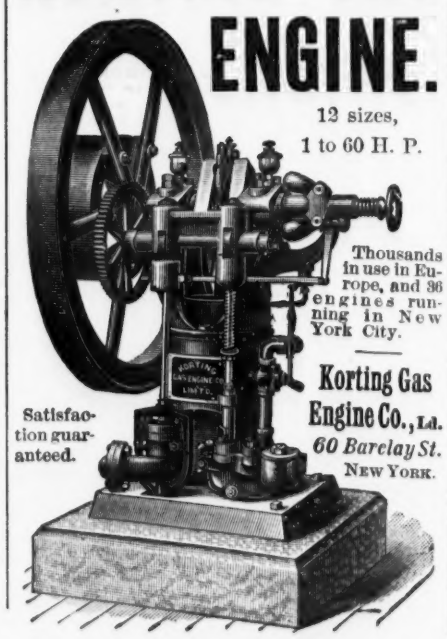
Power Pipe Cutting and Threading Machines, Cutting-off Machines, Ratchet Drills, Special Machinery, etc., etc.

WRITE FOR CATALOGUE.

Mention Paper.

KORTING GAS ENGINE.

12 sizes,
1 to 60 H. P.



Thousands in use in Europe, and 36 engines running in New York City.

Satisfaction guaranteed.

Korting Gas Engine Co., Ld.
60 Barclay St.
NEW YORK.

ROSE POLYTECHNIC INSTITUTE,

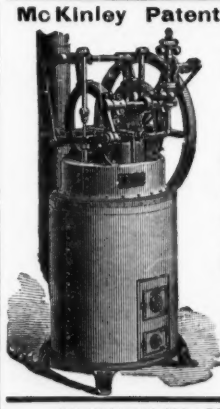
TERRE HAUTE, IND. | A School of Engineering.

Well endowed, well equipped departments of Mechanical and Civil Engineering, Electricity, Chemistry and Drawing. Extensive Shops and Laboratories For Catalogue, address T. C. MENDENHALL, Pres

---

McKinley Patent

Air Engine.



The Best and Cheapest on the Market.

No Steam. No Water. Absolute Safety. No Engineer. No pumps. No Gauges. No liability to freeze up. No Regulation required.

NO EXTRA INSURANCE.

Can be used for any purpose where power is required.

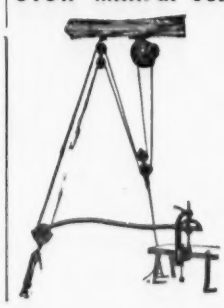
Cheap Fuel. Cheap First Cost.

McKinley Engine Co.
17 Broadway,
CINCINNATI, O.

VOLNEY W. MASON & CO.,
Friction Pulleys, Clutches and Elevators,
PROVIDENCE, R. I.

Planer Vises, 9 Sizes.
SPECIAL MACHINERY DESIGNED AND BUILT.
The Gilkerson Machine Works,
Write us. HOMER, N. Y.

STOW MANFG. CO., Binghamton, N. Y.

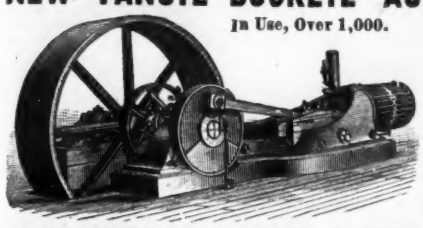


FLEXIBLE SHAFTS,
TAPPING and REAMING MACHINES,
Portable Drills,
ALSO FLEXIBLE BORING MACHINES

For Ironing Carriages and Wagons; Boring for Pinning Sash, Doors and Blinds, also for Stair Work.

NEW TANGYE BUCKEYE AUTOMATIC CUT-OFF ENGINES.

In Use, Over 1,000. 25 to 1,000 H. P.



These engines are the combined result of long experience with automatic cut-off regulation, and most careful revision of all details. They are designed and constructed for heavy and continuous duty at medium or high rotative speeds. Highest attainable Economy in Steam Consumption and superior regulation guaranteed. Self-contained Automatic Cut-off Engines 12 to 100 H P. for driving Dynamo Machines *a specialty*. Illustrated Circulars, with various data as to practical Steam Engine construction and performance, free by mail. **Address, BUCKEYE ENGINE CO., Salem, Ohio.**

SALES AGENTS: W. L. SIMPSON, 301 TELEPHONE BUILDING, N. W. ROBINSON, cor. Clinton & Jackson Sts., Chicago, Ill. 18 CORTLANDT STREET, N. Y. ROBINSON & CARY, St. Paul, Minn.

KENSINGTON ENGINE WORKS, LIMITED, PHILADELPHIA.

Sole Licensees and Manufacturers for New Jersey (South of Trenton), Eastern Pennsylvania, Delaware, Maryland and Virginia.

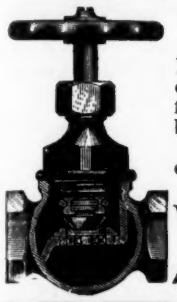
OTTO GAS ENGINE AGENCY, NEW YORK,

A. C. MANNING & CO.,

47 DEY STREET,

REMOVES on May 1st, to 18 VESEY ST.

BLESSING'S RENEWABLE-SEAT GLOBE, STRAIGHTWAY and CHECK VALVES.

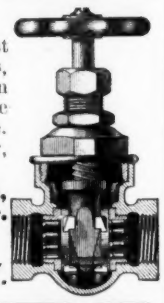


The renewable Seats and Disks are cast from the best Phosphor Bronze Metal, which has lasting qualities, double that of the best Steam Metal commonly used in first-class valves. The Seats are simply screwed to place by the use of a special wrench furnished with each valve. These valves are equally applicable to steam, water, or other fluid pressure.

We also manufacture **Blessing's Albany Steam Traps, Water Circulator and Purifier; and Pump Governor.**

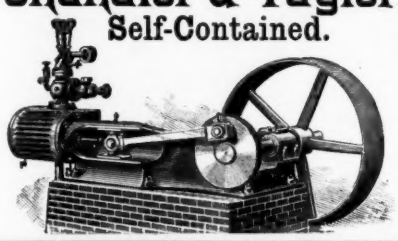
SEND FOR CIRCULAR.

ALBANY STEAM TRAP CO., Albany, N. Y.



Chandler & Taylor's STEAM ENGINES

Self-Contained.



Are Strong, Well-Built and Serviceable.
Are designed for Heavy and Continuous Work.
May be run at High Speed when desired, performing the duties of High Grade Engines,
And are sold at the prices of ordinary Engines.

For Prices and Descriptive Circulars, address

CHANDLER & TAYLOR,
INDIANAPOLIS, IND.

THE SKINNER ENGINE CO.

ERIE, PA.

PORTABLE AND STATIONARY
ENGINES and BOILERS
Send for Catalogue and Prices.

PORTER-HAMILTON ENGINE.

FOR HEAVY WORK AND LARGE POWERS.
EXTRA HEAVY DESIGN.
Send for Catalogue.

WILLIAM TOD & CO.,
YOUNGSTOWN, OHIO.

MACHINE TOOLS.

NEW AND SECOND-HAND, ON HAND.

12 in. x 6 ft.	Engine Lathe,		new.
13 in. x 6 ft.	"	Ames,	"
14 in. x 6 ft.	"	Blaisdell,	"
14 in. x 6 ft.	"	Prentice,	good as new.
15 in. x 5 & 6 ft.	"	Wood and Light,	good order.
16 in. x 6	"	Second hand.	
16 in. x 8-10 & 12 ft.	"	Bridgeport,	new.
16 in. x 6	"	Blaisdell,	"
19 in. x 12 & 14 ft.	"	Pond,	nearly new.
20 in. x 7	"	Ames,	fair.
20 in. x 10 ft.	"	Lathe and Morse,	"
20 in. x 10 & 12 ft.	"	Ames,	new.
24 in. x 10 12 14 & 20 ft.	"	Ames,	"
25 in. x 8-12 & 14 1-2 ft.	"	Bridgeport,	"
24 in. x 16 ft.	"	New Haven,	good order.
28 in. x 21 in.	"	N. Y. S. E. Co.,	good order.
30 in. x 14 ft.	"	W. and L. pattern,	new.
42 in. x 16 ft.	"	Ames,	"
52 in. x 24 1-2 ft.	"	New Haven,	A 1.
16 in. x 42 in.	Planer,	Bridgeport,	new.
16 in. x 42 in.	"	Pratt & Whitney,	good order.
22 in. x 4 ft.	"	Pease,	new.
22 in. x 4-5& 6 ft.	"	Powell,	"
22 in. x 4 1-2 ft.	"	N. Y. S. E. Co.,	cheap.
22 in. x 5 ft.	"	Hendey,	new.
24 in. x 6 ft.	"	Hendey,	"
24 in. x 4 ft.	"	Wood and Light,	good.
26 in. x 5 ft.	"	Biglow,	"
26 in. x 7 ft.	"	Brettell,	new.
28 in. x 7 ft.	"	New Haven,	fair.
30 in. x 7 ft	"	New Haven,	"
30 in. x 8 ft.	"	Hewes & Phillips,	new.
30 in. x 10 ft.	"	Hendey,	"
36 in. x 12 ft.	"	Niles Tool Works,	A 1.
12 in. Shaper,		Traveling Head,	new.
13 in.	"	Hewes & Phillips,	"
12 in.	"	Carpenter & Plais,	good order
12 in.	"	Jeungst,	new.
20 in.	"	Jeungst,	good as new.
24 in.	"	Bridgeport,	new.
24 in.	"	Wolcott,	"

16-18-20-23-25-28-34 in. Drills. 38 in. & 30 in. Radial Drills.
Merrill Drops, 400 and 800 lbs., good order.
Bement 2250 lb. Steam Hammer.
Milling Machines, Screw Machines, Slate Sensitive Drills, Gang Drills, and full line of all kinds of Machine Tools.
Send for list and specify what is wanted.

E. P. BULLARD,
72 Warren Street and 62 College Place, New York.

FRICTION CLUTCH PULLEYS.

HOISTING ENGINES, ELEVATORS, STEAM AND BELT POWER.

D. FRISBIE & CO., 112 Liberty St., N. Y.

To Buyers of Engine Lathes

We are now making from entirely new designs, *extra heavy* 19" and 21" Engine Lathes (the most popular sizes), of which we are making a specialty, and manufacturing in lots of not less than 100 at a time.

We make no charge for extras. Every lathe is furnished with *hollow spindle*; the 19" with 1⅝" hole, and 21' with 1⅞" hole. Every lathe has substantial *compound rest*, heavy tool post (bar steel), rest to turn full swing, *following rest* with adjustable jaws to take any size from 2½" down, with extra tool for shafting.

Full set of gears to cut from 2 to 18 threads including 11½ pipe thread. *Automatic stop on carriage. Separate screw and rod feed*, and the most substantial and easily managed *taper attachment* made. Cones and gears of large diameter and wide belt. Studs, screws and small gears are *steel or gunmetal*. Webbed live heads, heavy tail stocks. No worm or worm gears, no weak reverse plate. *Perfect lubrication for all running parts*, including carriage.

Lead screw inside of shear, double nut (cut from solid), and taking hold of carriage directly under the line of strain. Friction counter-shaft, the most durable made. Our prices are reasonable for cash, and from which no deviation will be made. Our written guarantee accompanies every lathe.

GUARANTEE.

We guarantee this lathe to be equal in workmanship, truth, accuracy, solidity, material and finish, to the best made, and hold ourselves legally liable for this guarantee.

LODGE, DAVIS & CO.

MANUFACTURERS

Machine Tools,

159, 161, 163 and 165 EGGLESTON AVE.,
136, 138, 146, 148, 150, 152, 154 E. 6th St.

CINCINNATI, OHIO.

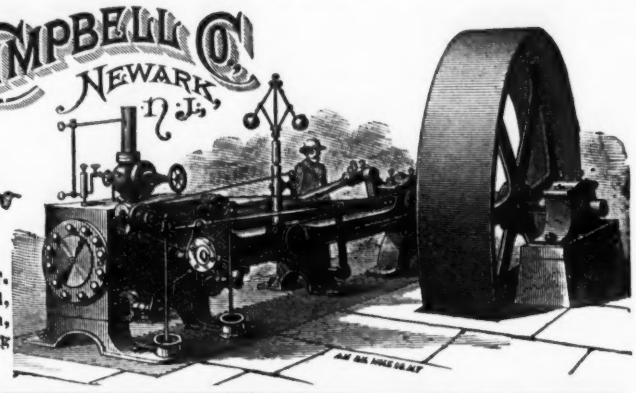
(See our advertisement on last page.)

The WM. CAMPBELL CO.

NEWARK, N. J.

MANUFACTURERS OF IMPROVED CORLISS STEAM ENGINES IN FULL VARIETY.

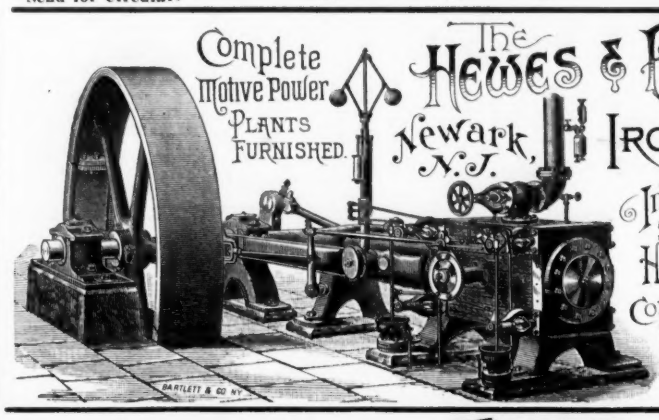
Sizes Varying From
30 to 2000 Horse Power.
Horizontal or Vertical, Direct Acting or Beam, Condensing, Non-Condensing or Compound.
Send for Circular.



The HEWES & PHILLIPS IRON WORKS

Newark, N. J.

Complete Motive Power Plants Furnished.

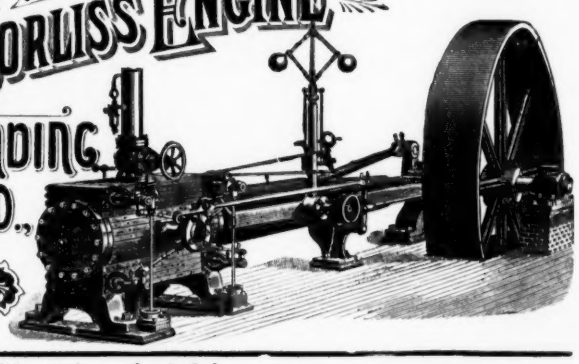


Improved CORLISS ENGINES,
High Pressure.
Condensing and Compound
TUBULAR BOILERS.
GEO. A. BARNARD
· AGENT ·

THE IMPROVED FISHKILL CORLISS ENGINE

BUILT BY THE FISHKILL LANDING MACHINE CO.,

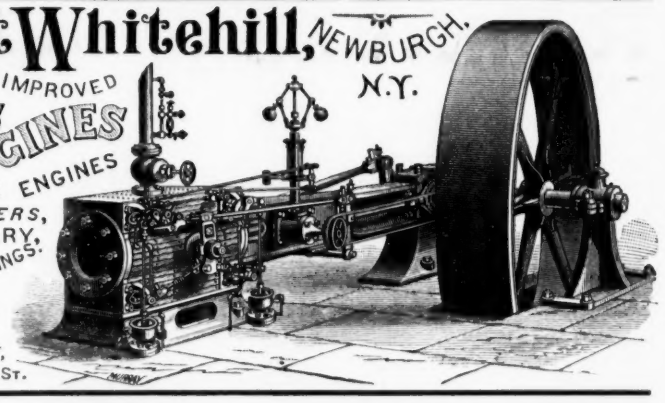
FISHKILL ON THE HUDSON, N. Y.

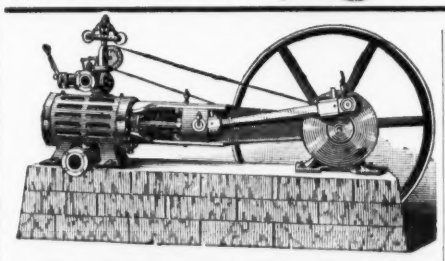


Robert Whitehill, NEWBURGH, N. Y.

MANUFACTURER OF IMPROVED
CORLISS ENGINES
ALSO SLIDE VALVE ENGINES
STATIONARY BOILERS,
GENERAL MACHINERY,
IRON AND BRASS CASTINGS.

NEW YORK OFFICE
Room 6,
COAL AND IRON EXCHANGE,
COR. CORTLANDT & CHURCH ST.





STEARNS MFG. COMPANY,

ERIE, PA.

Engines from 15 to 400 Horse Power.

Boilers of Steel and Iron supplied to the trade or the user. Send for Catalogues.

SAW MILLS and GENERAL MACHINERY.

Works at ERIE, PA.

Having enlarged our Foundry and otherwise added to our facilities, we are prepared to execute orders for castings weighing from a few pounds to *forty tons*. Our Boring and Turning Mill is one of the largest in the United States, by which we can bore and turn a wheeel or cylinder up to 30 feet in diameter, and we can plane 30 feet long by almost any width. With our *unsurpassed* means for handling heavy work, and shipping *by boat or rail*, we are enabled to

OFFER INDUCEMENTS

to customers.

We make a specialty of machinery for making Sugar, and furnish everything necessary to fully equip Sugar Refineries or Plantations. Satisfaction guaranteed, and patronage solicited.

S. S. HEPWORTH & CO.,
"Glenwood Station," Yonkers, N. Y.

JOHN McLAREN,

HOBOKEN, N. J.

BUILDER OF

CORLISS ENGINES,

AIR COMPRESSORS AND BOILERS.

SECOND HAND

CAR WHEEL and AXLE MACHINERY,

One 42 in. Car Wheel Borer, built by the New York Steam Engine Co.

One Hydraulic Wheel Press, built by the Taunton Fdy. & Machine Co.

One Car Axle Lathe, 15 in. swing 11 ft. bed, built by Fitchburg Machine Works.

These three machines are in first rate condition.

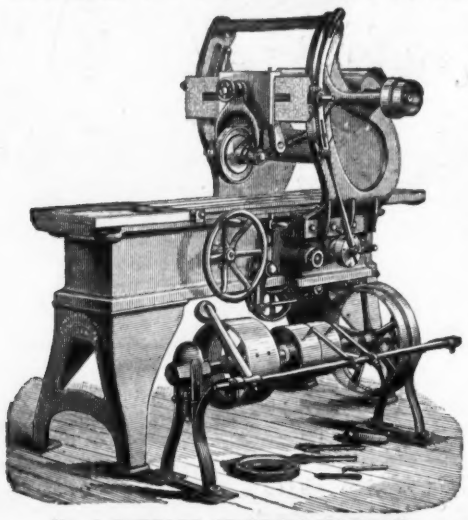
Hill, Clarke & Co.,
36 OLIVER ST.,
BOSTON, MASS.

BROWN & SHARPE MFG. CO.

Manufacturers of

MACHINERY AND TOOLS,

PROVIDENCE, R. I.



No. 3 SURFACE GRINDING MACHINE.

This Machine is designed for flat and true surface grinding and finishing. It is an effective substitute for the operations of filing and stoning. The entire cost of files, and three-quarters of the labor usually expended on these operations are saved, beside obtaining better surfaces upon the work done. For all finished parts of machinery of cast iron or steel, hard or soft, for punches or dies, straight edges, flattening dies, etc., it will prove invaluable, and will produce fine work with little expense.

It will Grind 14″ wide, 36″ long, 10″ high, using a 9″ wheel.

The countershaft has tight and loose pulleys 8″ diam., 4″ face, and should run about 276 turns per minute.

Price includes countershaft, wrenches, etc., all complete, delivered F. O. B. at Providence, R. I. Weight, 2,500 lbs.

We are prepared to furnish this machine lengthened, to grind 5 ft. long. Weight, 3,000 lbs.

ILLUSTRATED CATALOGUE MAILED ON APPLICATION.

THE PRATT & WHITNEY COMPANY,

Hartford, Conn.

MANUFACTURE

PLANERS

to plane 16 in. x 16 in. x 3 ft., to 60 in. x 60 in. x 20 ft., with quick return motion.

PILLAR + SHAPERS

with 6 in. x 10 in. stroke

Shaping Machines

with 12 in. and 14 in. stroke, all feeds automatic.

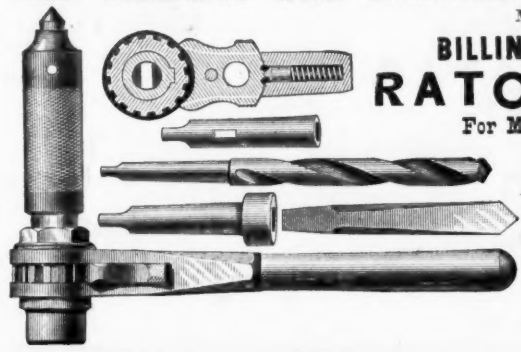
PRICE LIST

— AND —

Discount Sheet

SENT UPON APPLICATION

THE BILLINGS AND SPENCER CO., HARTFORD, CT., U. S. A.



MANUFACTURERS OF

BILLINGS' DOUBLE-ACTING RATCHET DRILL

For Morse Taper Shank Drills.

Packer Ratchet Drills,

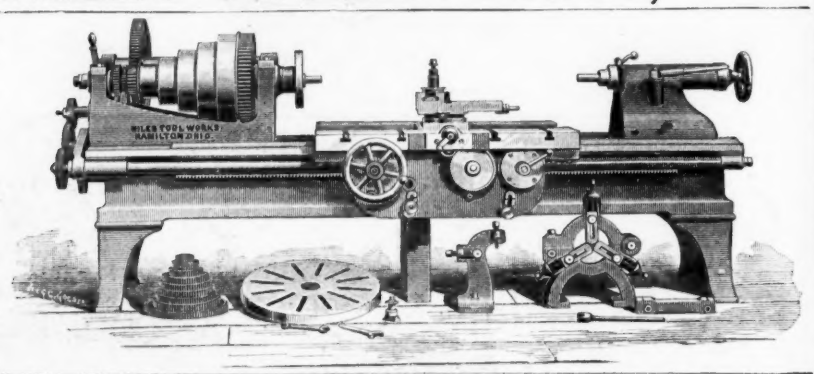
Packer Boiler Ratchet Drills,

Packer Auger Ratchet Drills,

DROP FORGINGS

OF EVERY DESCRIPTION.

NILES TOOL WORKS, HAMILTON, OHIO.



Lathes, Planers, Shapers, Slotters, Etc.

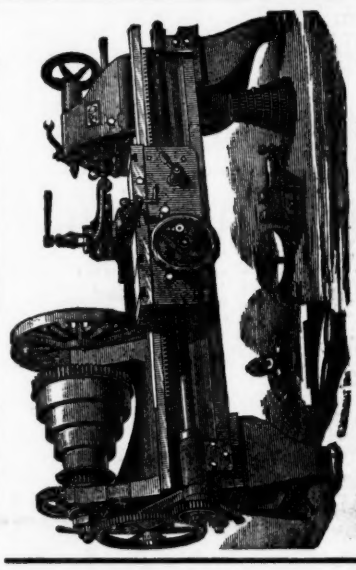
Vertical Milling Machine.

WARNER & SWASEY,

CLEVELAND, OHIO.

Machine Tools FOR **IRON & BRASS WORK.**

Send for Illustrated Catalogue.



Engine Lathes, Planers, Drills, &c.

POND MACHINE TOOL CO., SUCCESSORS TO DAVID W. POND,

New Designs, Quick Delivery. Great Variety. Worcester, Mass.

POWER

TRAVELING CRANES.

Particulars on application. Full Specification and Tender promptly submitted on receipt of capacity and span of bridge desired.

MAKERS,

The Yale & Towne Mfg. Co., Stamford, Conn.

NEW YORK—CHICAGO—PHILADELPHIA—BOSTON. Catalogues on application.

GEO. W. FIFIELD,

MANUFACTURER OF

ENGINE LATHES

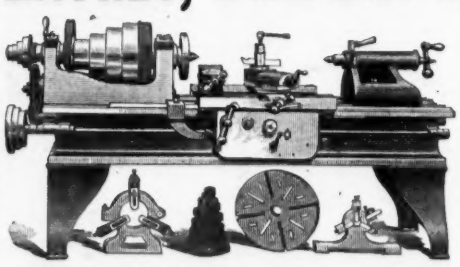
FROM 16 TO 48 IN. SWING.

Cuts, Photographs and Prices furnished on application.

Lowell, Mass., U. S. A.

ENGINE LATHES, SHAPERS & DRILLS.

20-INCH LEVER DRILL.



20 in. Upright Drill
24 " " "
26 " Back Geared and
30 " Power Feed
38 " Drills.

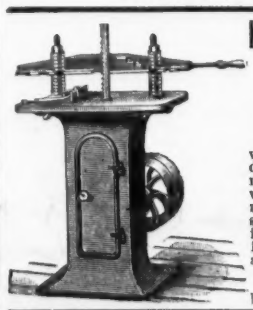
LODGE, DAVIS & CO.

CINCINNATI, OHIO.

Send For Prices. It Will Pay You.

26-INCH BACK GEARED AND POWER FEED DRILL.

GEAR WHEELS AND GEAR CUTTING.—I make g to order, or cut teeth on g blanks sent to me. Of all kinds. Of all sizes to six ft dm. Small orders or large ones. Fine g or cheap g. Small cast g. Ready made brass g by mail at low prices. Bevel g with perfect planed teeth. Hand Book on g, $1. Facilities complete. Terms reasonable. Send for cat. GEO. B. GRANT, 66 Beverly St., Boston, Mass.



KEY-SEATING MACHINES,

and 20-in. Drills,

A SPECIALTY.

Our Key-Seating Machine will save enough in 60 days' use to pay first cost; no shop can afford to do without one. We have now ready for prompt shipment both Key-Seating Machines and 20-in. Drills. Send for Photo. and Catalogue.

W. P. DAVIS,

NORTH BLOOMFIELD, N. Y.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.

HARTFORD, CONN.

J. M. ALLEN, PRESIDENT.

W. B. FRANKLIN, VICE-PRESIDENT.

J. B. PIERCE, SECRETARY.

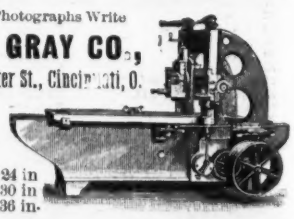
For Prices and Photographs Write

THE G. A. GRAY CO.,

Sycamore & Webster St., Cincinnati, O.

Lathes, 17 in. 20 in.

Planers, 26 in. x 24 in. 32 in. x 30 in. 38 in. x 36 in.



E. GOULD & EBERHARDT

NEWARK, N. J.

Eberhardt's Patent

AUTOMATIC GEAR CUTTER.

18 in. 25 in. 36 in. 50 in. 60 in. 84 in. Sizes.

"Experts pronounced it the best."

E. E. GARVIN & CO.,

MANUFACTURERS OF

Machinists and Iron Workers' Tools.

Universal Milling Machine.

WE RECEIVED GOLD MEDAL FOR OUR NEW UNIVERSAL MILLER AT NEW ORLEANS EXHIBITION. (See cut.)

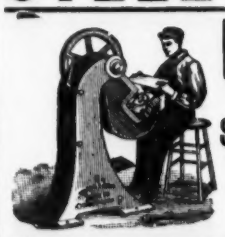
Lathes, Planers, Milling Machines and Drills. Special Tools for all kinds of manufacturing to order. Gear and Rack Cutting, Milling and Index Drilling to order.

Nos. 139 to 143 CENTRE ST., NEW YORK.

STEEL CASTINGS.

PRATT & LETCHWORTH, PROPRIETORS

Buffalo Steel Foundry, BUFFALO, N. Y.



PUNCHING PRESSES, DIES,

And other Tools for the Manufacture of all kinds of

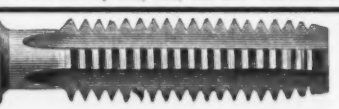
SHEET METAL GOODS, DROP FORGINGS, —ETC.— DROP HAMMERS.

STILES & PARKER PRESS CO.

MIDDLETOWN, CONN.

Branch Office and Factory 203, 205, and 207 CENTRE STREET, NEW YORK.

J. M. CARPENTER PAWTUCKET, R. I.



Manufacturer of TAPS & DIES